Investigating the Paradigms of Sikkim’s Built Environment

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Investigating the Paradigms of Sikkim’s Built Environment

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Abstract

The region of Sikkim is located on the Aplide-Himalayan global seismic belt, a seismically vulnerable area of the world. The 2011 M6.9 earthquake caused a severe disruption in the functions of both rural and urban Sikkim. In areas populated by humans, most of the visible damage and harm done in an earthquake is due to poorly designed and constructed buildings and infrastructure rather than the earthquake itself. The focus of this paper lies in the study of the relationship between the predominant building types of rural vs. urban Sikkim. Ikra is a low cost vernacular building type found in Sikkim’s rural village setting. Reinforced Concrete (RCC) is the bulk of the built environment in Sikkim’s high density urban setting. Both types of construction result in structurally reliable buildings when subjected to the lateral forces of an earthquake. However faulty practice and implementation can lend a different result. In the 2011 earthquake, Ikra constructed buildings suffered little damage immediately responsible to the earthquake. In contrast, many of the RCC buildings in the affected areas suffered from the strong lateral forces, resulting in harsh diagonal cracks and on occasion complete structural failure and collapse.

Because of Ikra’s resilience in seismic conditions this paper will explore the ways it is still utilized in the village context. It will delve into the material shift from vernacular building technologies, specifically Ikra, to the use of RCC. And it will begin to explore the future possibilities of utilizing both local and urban knowledge in the design and construction of buildings. The goal is to hatch out a relationship that will serve to combine low-cost, local sustainable building technologies with efficient strong modern technologies and design theory. The different housing typologies of Sikkim and the dynamic which has dictated a change in building trends, has been investigated through direct observation and via interviews/interractions with both rural and urban inhabitants. In particular, the Ikra building technology has been explored via the direct observation of rural village Lingee Payong’s built environment, through participatory observation on construction sites, and through interviews and observations of local builders and building inhabitants. The process culminated in participatory design sessions with the local community of Payong to design a house for the government program, Reconstruction of Earthquake Damaged Rural Houses (REDRH) that is reflective of the people, the culture, and the lifestyles of the community of Payong.

Introduction

“Culture must be backed by the objective reality of an area.”

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Earthquakes are generally notable relative to the amount of damage they cause. A large component of whether an earthquake will cause severe damage is dependent upon an area’s preparedness. This not only includes primary attention and care once the

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1 Lingmo Informant 1, participant observation, Lingmo Village, Sikkim, 27, April, 2013.
earthquake has struck, but to what prior measures has an area prepared to minimize an
earthquakes effects. One clear way to accomplish this is to construct buildings that will
withstand earthquake strengths relative to the areas seismic vulnerability. A buildings
materiality and construction has a great deal to do with how susceptible it will be when
subjected to the forces of an earthquake. The two materials focused on in this paper are
Ikra, and reinforced concrete (RCC). Ikra is a vernacular building technology found
across northeastern India and is the predominant typology in rural Sikkim. The
lightweight nature of the building coupled with flexible structural connections minimizes
damages suffered during an earthquake.\(^2\) In the 2011 earthquake, the only visible damage
to Ikra-style buildings were to those of G+2 story buildings. They performed much better
than their fellow RCC buildings that sustained extensive damage.\(^3\) RCC should perform
very well in earthquakes if it is designed and implemented according to building code.
While cement is a brittle material, which gives little warning before catastrophic failure,
reinforced concrete is supported with steel rebar, which greatly increases the ductility of
the material and allows for greater deformation before failure. Because of the extensive
damage seen throughout Sikkim in RCC buildings it can be concluded that they are not
being built according to Sikkim’s seismic code. India is not foreign to earthquakes of
great magnitude. Each state has seismic building codes according to its seismic zone type
II, III, IV, or V.\(^4\) Sikkim currently classifies as a type IV, severe intensity zone. However,


\(^3\) Kaushik, Hemant. "Assam-Type Housing." *World Housing Encyclopedia*. Earthquake Engineering Research Institute (EERI) and International Association for Earthquake Engineering (IAEE).

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post the 2011 earthquake it has been taken into consideration to reclassify it as a zone type V.

The entire world is not affected equally by the threat of earthquakes. However, increasing global awareness about the importance of disaster reduction has led to governments and organizations working together to raise preparedness in areas that are. Such international efforts can be “traced back to the International Decade For Natural Disaster Reduction (1990 IDNDR)”. In such efforts there is a particular focus on earthquakes that claim 50% of the lives claimed by natural disasters. India has developed four virtues of what constitutes an earthquake-resistant building: good structural configuration, sufficient lateral strength, adequate stiffness, and good ductility (Resonance). Out of these are birthed the seismic codes that are relative to each specified seismic zone type. The Bureau of Indian Standards (BIS) backs this ideology:

The regulations in these standards do not ensure that structures suffer no damage during earthquake of all magnitudes. But, to the extent possible, they ensure that structures are able to respond to earthquake shakings of moderate intensities without structural damage and of heavy intensities without total collapse.

Proper building codes however can greatly affect how an area responds to an earthquake. This is evident around the world. In Peru, a code created in 1977 proved ineffective in the Nazca earthquake, which struck in 1996. In this earthquake Peru’s vulnerability was exposed as even newly constructed buildings suffered form the disaster. Because of this

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6 Ibid.
8 Ibid.
9 Aguilar, Zenon. SEISMIC VULNERABILITY OF SCHOOL BUILDINGS IN LIMA, PERU. Proc. of 13th World Conference on Earthquake Engineering, Vancouver, B.C., Canada.
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Peru drafted a “new earthquake-resistant design code” in 1997.\textsuperscript{10} In the 2001 Arequipa earthquake, the code proved successful as no buildings built since the code was passed were visibly damaged.\textsuperscript{11}

In designing to meet the minimum needs of what can qualify as a seismically resistant building, the demographic of people and the specific environment must be taken into account. Around the world, designing sustainable low cost buildings is becoming a greater need but also a starting trend. The use of bamboo is provides for a great source of construction need in many parts of Asia and Latin America. The sustainability and versatility of bamboo has reignited the material for engineering uses among the professions of architecture and engineering.\textsuperscript{12} Bamboo rivals strength tests achieved by mild steels, grows to maturity within 4-5 years, and it is very effective in sequestering carbon. It also has a very high ratio of load bearing strength capacity to weight of material.\textsuperscript{13} For these reasons it serves as a prime substitute for the traditional timber frame roof used in Ikra construction. Sikkim serves as an interesting case study for the investigation of building materials, especially in relation to seismic resilience. It represents both the failure of the implementation yet the importance of building codes and the value often over looked for modernity in natural based local knowledge. It also leaves a question in the future of where a focus will lie in Sikkim’s construction industry. However, it seems that in the realm of one to two story buildings, “locally available materials (such as bamboo and timber) and traditional technologies which have proven

\textsuperscript{10} Ibid.
\textsuperscript{11} Ibid.
\textsuperscript{12} Shyamasundar, Shri K. \textit{Promotion of Bamboo Housing System & Recent Developments}. Rep.
\textsuperscript{13} Ibid.
their ability to resist earthquake loads should be reinstated and integrated with modern construction practices to have an appropriate design for strong and safe housing”.  

Currently because of the political and social sway that modern technologies hold, in this case RCC, it will require a strong push to see this occur on a large scale in Sikkim. But because Sikkim is such a seismically vulnerable area, the implications of the current implementation and transition to using RCC predominantly are drastic.

The transition from vernacular building technologies to modern ones is not inherently negative. Clear restrictions apply to most vernacular building technologies, for the case of Ikra, there are height limitations to how many stories can be built. When that is then applied to an urban area, a problem of density arises. For population accommodation and to maximize the efficiency of usage of space, using a material such as RCC to support vertical styled construction is logical. However in Sikkim there are two issues with the extensive use of concrete that fall beyond the reasoning of efficient use of space. One is that the RCC buildings being constructed are not being designed to code. Given Sikkim’s zone type IV, potentially V, classification, the consequences of this are deadly. And with the occurrence of another high magnitude earthquake, they might be weighed in loss of human life. The second issue is the image of pucca and modernity that is associated with concrete. Because Sikkim is a mountain state, it has not progressed into a status of modernization as quickly as other Indian states. However, its State strives for such a status. Producing concrete buildings, as a façade of modernity may be a tactic

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employed by both the people and state of sikkim, but when implemented poorly and dangerously, it quickly becomes misguided.

the government has responded to the damage of the earthquake with various programs, specifically in rural areas such as the chief ministers rural housing scheme. after the earthquake the local panchayat’s toured their villages making sheets on damage estimates. based on those estimates people either qualified for various amounts of compensation for repair or for an entire house if the damage was severe enough. the houses provided for the people via the government programs were simple RCC buildings. the houses contain a kitchen/dining room, a bathroom, two bedrooms, and a roof terrace that either acts as a habitable roof or allows for future expansion. the house has not been designed in coordination with the people of the villages of whom they are serving. the preference in the aesthetic and layout of Ikra homes seems to be represented by the majority of the population in Lingee Payong. but people have never been mobilized to discuss the topic of housing in a community setting. because of this the distaste with the RCC buildings has never been voiced or acted upon. a large reason for this is that because the houses are being provided free of cost to people in need they are not in a place to express displeasure. Concrete as a material connotes longevity and also a status of “pucca”. And because of this many people are satisfied with an RCC house. However it is been found that if provided a choice, many people would prefer a house made of Ikra. By bringing people of the community together to discuss housing, it started to raise ideas never discussed before. It resulted in a set of designs created by the community themselves that are reflective of themselves, their culture, and their needs out of a home.

15 Payong Informant 1, Participant Observation, Payong Village, Sikkim, 22, April, 2013
16 Mason Training Handbook, Rural Management and Development Department, Government of Sikkim
A Green Retreat

The villages of Lingee and Payong are nestled in the green hills of the Himalayas. Lingee and Payong each reside as separate neighboring localities. The population of the area does not exceed that of a few thousand residents. The access to the villages remains a teetering off road experience while the local villagers eagerly await a paved road system. Agriculture still prevails through the village providing a great amount of the consumed resources to an otherwise greatly unemployed population. It should be kept in mind that the status of unemployment is reserved for anyone that is not employed by the government or private company. In the past the villages had thrived as a self-sufficient agricultural community. More recently a helplessly created connection to the outside world, mainly the market centers of Singtam and Gangtok have altered the patterns of life. This has created an often-undesired dependency of the villagers on these market centers for goods, health treatment, and higher education. Accompanying this relationship has been changes to the built environment and visible housing typologies of the area. Materials such as cement and steel rods, which require importation, can now be seen throughout the villages and the surrounding villages of Lingmo and Sokpei. The great majority of these materials are being utilized in government-sponsored projects, however, among a population of the more affluent members of the community, RCC buildings maintain an appeal.

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17 Payong Informant 2, Participant Observation, Payong Village, Sikkim, 26, April, 2013
18 Lepcha Informant 1, interview, Lingee Village, Sikkim, 20, April, 2013, at 10:00.
Site Analysis

The first step of the design process is to investigate the context, background, and the clientele group or beneficiaries. In order to accomplish this walking tours were arranged to get acquainted with the typologies in Lingee, Payong, Lingmo, and Sokpei. Trekking from one house to another, an introduction to the vast interconnected community of the area, and an in person examination of housing types and living patterns gave an excellent lens into the life of the rural villages. The primary focus of the treks was the direct observation of the different housing types: Ikra, Chitra, Wood, RCC, single story stone and mud plaster, and traditional Lepcha and Nepali homes. As an aspect of learning about the typologies themselves, it became important to begin to understand the paradigms of the built environment, and the transitions between each material.

The traditional houses of the area are of Lepcha and Nepali origin. The predominant housing type pre 1970 in the area was single story stone and mud plaster homes.\textsuperscript{19} The single room of the homes served as a kitchen, living, and bedroom space. The roofs of the homes were made out of thatch. Because all the materials for the homes were found in the immediate area of the building area, the homes were relatively no cost beyond the effort of labor and provided for fairly simple construction. There are unfortunately limitations to this style of home. The homes do not have long life spans, and they do not hold up well in the conditions of an earthquake. Traditional Nepali homes are two to three stories and expand upon the single story stone homes. The ground floor is made of finely fitted stones and sometimes mud plaster. The second and third stories are then of a lighter weight material such as wood. The traditional roofs were made of

\textsuperscript{19} Payong Informant 2, Participant Observation, Payong Village, Sikkim, 20, April, 2013
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thatch. The ground floor of the house was used as a kitchen/dining/living room. It was the most utilized room of the house. The first floor was used for bedrooms. And the third floor was used for both storage and an extra bedroom space if the size of the family required it. The woodcarving of the Nepalese is particularly impressive. Intricately carved doorways, window frames, railings, and roof edges give a subtle yet beautiful aesthetic. The design of the houses is a strong reflection of the culture of the people. The woodcarving and aesthetic is one aspect. Another, which is commonly found, is illustrated in the low height of entryways. Doorways were designed with low heights to allow for a compulsory bow and an accompanied spoken namaskar upon the entry of a space.20 This was witnessed in a dilapidated, yet profound traditional home in the village of Lingmo. The structure, over 100 years old, had been serving as a home until the September 18, 2011 earthquake. Certain members of the community acknowledge the house as a cultural relic, and an attempt to restore and maintain it is intended.

The current Lepcha houses in the area of Lingee Payong are very similar in design to those of Nepalese origin. Originally Lepcha houses were solely composed of intricate bamboo and wood joinery that did not require the use of nails. The structures were two stories and had a thatch roof. The ground floor was used for both animal husbandry and storage. The first floor was then used as a kitchen/dining space and for bedrooms. The skillful craftsmanship of Lepcha builders can be seen in the modern structures as well. Similar complex joinery can be seen in the timber aspects of the homes. After adopting the Nepali method of using stones as a ground floor structure, the Lepcha’s began to not only finely join the stones, but to also cleanly cut the façade sides to create a near level

20 Lingmo Informant 2, interview, Lingmo Village, Sikkim, 27, April, 2013, at 15:00.
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plane. The buildings also utilized passive heating techniques in material choice and placement of fenestrations to keep the home warm during the wintertime but cool during the summer months. The building techniques of houses built a two to three generations ago had a meticulously scrutinized quality of both structural connections and materials. This resulted in buildings that had durability and long life spans. The few traditional homes left in Lingee Payong can be traced back to as long as 100 years ago. In more recent times, such quality is difficult to find in buildings being constructed, and with that the longevity of the area’s built environment has dropped as a whole.

Ikra homes or “cottages” are the most prevalent building typology seen throughout the villages of Lingee, Payong, Lingmo, and Sokpei. The housing type was introduced in the 1970’s to the area as a lightweight building alternative that utilized local materials. The houses are composed of a two and a half to three foot stone masonry or brick wall that sits on a plinth. On top of this is a timber frame that serves as the primary structure. In between timber framing pieces, panels are created out of woven bamboo. The bamboo for these panels is best harvested in the wintertime because the bamboo is less sweet. This is the local knowledge utilized to try and deter insects and disease, which feast on the sugars of the grass. Either a mud or cement plaster is then placed as a finish and sealant on top of the woven bamboo. The mud plaster is merely composed of mud, sawdust, and water. The ease and accessibility of these materials contributes to its sustainability. However, mud plaster panels require more upkeep than cemented ones. Because of this, people if given a choice, tend to prefer cement plaster. The roofs of the

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21 Lepcha Informant 2, interview, Lingee Village, Sikkim, 20, April, 2013, at 11:00.
22 Payong Informant 1, Participant Observation, Payong Village, Sikkim, 21, April, 2013
23 Payong Informant 3, Participant Observation, Payong Village, Sikkim, 19, April, 2013
Ikra homes are pitched. The semi-habitable space created is often used for some type of storage. The roof material is predominantly corrugated sheet metal. Ikra homes in the context of the Lingee Payong region are modular. There are generally separate structures for a shower/toilet, kitchen, and general living space, bedrooms, living rooms, etc. Ikra is incredibly lightweight and has flexible structural connections that make it suitable for construction in a severe seismic zone. The clean aesthetic of the “cottages” is liked and preferred throughout the visited villages.

Chitra is less commonly found for formal living spaces, but is often used as a material for cowsheds or structures that necessitate a very low cost. Chitra is the simplest form of construction found in the villages. It consists of a basic timber frame, and an exterior of woven bamboo. The structures are of local materials, are easy to construct, and are very low cost. The downside is they are not very strong, durable, and do not insulate well. The use of wood panels is limited in the villages. Beyond its use in the more traditional homes, which are not constructed any more, there is only one all wood home, which is in Sokpei. The large factor for wood is cost. Harsh forestry laws have outlawed the felling of trees unless they are on private land. Because of this, in order to construct an entirely wood home would most likely require importation of wood from Siliguri. However, if affordable, wood provides a earthquake resilient structure, good inherent insulation values, and a pleasant aesthetic, enjoyed by many of the villagers. The last building type is reinforced concrete (RCC). The RCC buildings are either multi story homes of more affluent families, which are not common, or part of the government schemes that provide a nine pillar single story home. As previously states, the nine-pillar

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24 Payong Informant 4, Participant Observation, Payong Village, Sikkim, 29, April, 2013
25 Sokpei Informant 1, interview, Sokpei Village, Sikkim, 20, April, 2013, at 14:00.
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home consists of a kitchen/dining room, a bathroom, and two bedrooms.\textsuperscript{26} The roof is flat which makes it a habitable space and allows for vertical expansion in the future. RCC buildings are strong and durable if constructed properly, and the government has designed the nine-pillar homes to be resilient in an earthquake. However, the government has no means to ensure the proper construction of the buildings and on top of this they become a harsh break in the building aesthetic of the areas.\textsuperscript{27}

**Transitions in Building Technologies**

Investigating the transition of building materials and house typologies over time has served as the backdrop for the type of design pursued in this project. The original single story masonry homes of the area served a direct purpose for the lifestyle of that time. The single room home was conducive for the passing of knowledge and culture from each generation to the next.\textsuperscript{28} This was necessary because of the nonexistence of formal education. Through this manner, children would learn from their elders, either parents or grandparents, about the workings of the village and village life.\textsuperscript{29} The major transition in the area occurred in the 70’s with the construction of Ikra homes. Simultaneously, Sikkim merged to become India’s 22\textsuperscript{nd} state, and villages became more introduced to the system of formal education.\textsuperscript{30} Formal education placed less importance upon the sharing of knowledge between generations, as an importance became placed on outside knowledge. Ikra homes reinforced this as rooms became modular and there was

\textsuperscript{26} Mason Training Handbook, Rural Management and Development Department, Government of Sikkim
\textsuperscript{27} Chief Engineer of the State, interview, Gangtok, Sikkim, 6, May, 2013, at 11:00.
\textsuperscript{28} Payong Informant 1, Participant Observation, Payong Village, Sikkim, 21, April, 2013
\textsuperscript{29} Ibid.
\textsuperscript{30} Payong Informant 2, interview, Payong Village, Sikkim, 3, May, 2013
greater physical separation between proximity of rooms. The transition signified the start of a changing life style. Around the end of the 1990’s RCC buildings started to become introduced to the area. Concrete among the villagers holds a strong image. The terms “building” and often “pucca” are reserved only for RCC structures.\textsuperscript{31} As previously stated, concrete carries the association of strength, durability, and also a modern, urbanized image. Building a home out of RCC by choice tends to be an option only available to the more affluent members of the community. There are only a few cases of this in Lingee Payong, however, the prevalent answer for why the homeowners chose RCC as a building material was overall durability and life span. RCC also allows homes to be built vertically with multiple stories without compromising the structural safety of the building. The 2011 earthquake challenged the idea of the strength of concrete. In Payong, the earthquake caused catastrophic damage to the RCC government school building. Other concrete buildings illustrated large diagonal cracks in their walls. Comparatively, Ikra homes faired well. There were cracks and damage seen in some Ikra homes but it was limited to the stone/brick masonry walls, and simple cosmetic damage to some mud plaster panels. Because of this, it is well known among both carpenters and homeowners that the lightweight nature of Ikra is very positive for its reaction to earthquakes.

\textsuperscript{31} Lepcha Informant 2, interview, Lingee Village, Sikkim, 20, April, 2013, at 11:00.
Payong Government School Earthquake Damage: RCC vs. Ikra

The nine-pillar RCC homes provided by the government run the risk of suffering the same fate as the Payong government school if not constructed properly. Luckily, the 2011 earthquake struck when no one was in the building so there were no casualties. But when homes become built out of RCC the risk runs much higher for there to be inhabitants in the structure during the occurrence of an earthquake.

The transitions between building technologies and study of Lingee Payong’s built environment have surfaced two issues with which my design project attempts to address. The first issue deals with culture and it’s preservation. The construction of new traditional houses has completely halted and many of the existing traditional buildings were severely damaged in the 2011 earthquake. A large question has arisen with what to do with the remaining traditional homes in terms of quantifying their worth in relation to restoration costs. While this remains an issue, what became more focused on in the design process was how to utilize some of the best aspects of traditional architecture with modern technologies and design theory. And through those means, preserve aspects of cultural/architectural significance. The second issue, which became the priority in the
mind of the community, was in relation to earthquake safe architecture and the government’s response to the 2011 earthquake. The decision to use a participatory design method was to utilize the local cultural, living, and building knowledge. Through this the outcome would be a design that was reflective of what the community both wanted and needed. The design would be of the community for the community. Although architecture is a finely studied field, the idea of home becomes a sort of exception. People have lived in a home for their entire lives, and due to this have discovered aspects about spaces, conscious or unconscious, that they are either drawn to or not. Private homes are also the predominant type of building in the rural area of focus, which allowed for sufficient background study.

**Community Mapping**

The second step of the design process was a community mapping exercise. The goal was to obtain a map of Payong that illustrated the housing site, local natural resources, location of local carpenters, and the different building typologies. The exercise demonstrated the in depth and accurate knowledge of the villagers of their surrounding area. With all aspects of the map combined, it conveys the potential for near complete self-reliance on building materials, design knowledge, and means for construction and labor. It is found that most private land has accessible bamboo, some timber, potentially limited in terms of quantities needed for actual construction, stones, and sand coming from the Teesta River. Given the accessible materials, Ikra presents itself as a building type that can capitalize on the available natural resources. In theory, an Ikra house would only necessitate the importation of corrugated sheet metal roofing and nails. This would
mean following the traditional form of construction using stones rather than bricks for the masonry, and mud as a plaster and mortar rather than cement.

Map of Payong Village

Utilize the Community

The third step of the design process was the participatory design meeting. A group of both men and women, carpenters and farmers, numbering around 13 were gathered together to design a home. The community had never come together in a group setting to discuss the topic of housing. Because of this, the meeting started in an open discussion format, getting people acquainted with each other’s points of view. Although discussion was held at length, the first consensus reached was a unanimous vote in favor of designing out of Ikra. The reasons being that it is low cost, using local materials, and strong in earthquakes, ironically pointed out that its performance should be the opposite of the RCC building we were sitting in which sports large gaping cracks in its walls. This

32 Payong Informant 2, Participant Observation, Payong Village, Sikkim, 28, April, 2013
decision is also reflective of the findings of the community mapping exercise, and from the observations gathered from the different villages. Discussions were then held about what sorts of rooms should be included in the design and how the house should be situated to take into account lighting and wind patterns. It was decided that the average family size of Payong was around five, and that that should serve as the client base to serve. And that the house should be oriented with large eastern slope, which is the circumstances found through most of Payong. The group then split into two, each with the task of designing their ideal low cost Ikra home. The given number of participants was previously stated as “around” due to the fact that once on their own, within each respective group there were some who participated animatedly, some who drifted in and out, and some who left altogether. The women in particular, were very difficult to encourage to participate, and after grouping together in conversation for some time, they departed.

The groups worked for a couple hours to produce plans and sketched renderings of their new ideal homes. After completing their respective designs, they were brought back together to present their ideas in a compelling fashion and to discuss and hatch out the differences between the two ideas. Each design group had set themselves with the same program, one main house containing two bedrooms, a guest/home stay room, and a living room, one detached kitchen, and one detached shower/toilet. One group went for a very functional yet uncreative layout. The plan was focused around the main living house. It contained the four rooms stated above given equal square footage and laid out in a rectangular plan with a bisecting corridor that served as the entry both to the house and to the rooms. The kitchen and shower/toilet were then placed haphazardly on either side
of the home. The design was functional, provided ease in construction, and met the needs as stated by the group. The negative aspects were that it was not very dynamic in terms of relationships between spaces, meaning that there was no differentiation between what room was what either by size or location, and the kitchen, main house, and washroom facilities all stood as stand alone structures, there was no interaction between them.

Design Groups

The second design proved to be more dynamic in shape and layout, but with that also posed more serious issues than the other. The plan of the house was L shaped, and opened up to a courtyard facing the eastern slope. The design of the house allowed for ample natural lighting to reach each room. The rooms had begun to be differentiated between each other based on size. The living room was the largest room, one bedroom and the guest room were the same size, with the second bedroom being slightly smaller. As with the previous design there was little consideration taken into creating a relationship between the three modules of the house, the kitchen, main living house, and washroom. The larger problem that presented itself was with the roof. The seam of the
rooftop at the joint of both sections of the L creates a serious problem with the potential of water leakage. On top of this, they believed the roof would be much more expensive to construct. Because of the cost, and the potential for water leakage, which could potentially cause irreparable damage to the home, the first design was opted for.

**Present and Inform**

The fourth step of the design process, informing the proper audience, presented itself due to the active interest and participation of members of the community. At the Gram Sabha the question was raised by one of the design participants, as to why the government only provides the option of RCC buildings as a part of their housing schemes if the people receiving them do not necessarily prefer it. On top of this the ideas of retaining and recreating a cultural aesthetic with sustainable construction and stimulating local economy growth was touched on. This further opened up the forum of discussion to a public level. It also allowed for a meeting with two local Panchayat members, the video from the Block level, and the Block level inspector after the completion of the Gram Sabha. After the presentation of the design, they encouraged further discussion of the overall idea and design with more key political resources, interested to see its progression and possible implementation on behalf of the Payong community. This step continued in Sikkim’s state capital, Gangtok. Here meetings were arranged with the head of a local ecotourism and conservation NGO, ECOSS, a local architect, the chief engineer for the state, and the state legislator. At ECOSS, with the state legislator, and with the chief engineer, the importance of architecture and ecotourism was discussed. With the growing construction of RCC homes in rural areas, the cultural aesthetic is being lost. Not only
does this begin to affect the lives of the people in the village but also it affects potential future visitors, mainly through the growing business of ecotourism. The retention of the rural cultural aesthetic will prevent a homogenized landscape and will continue to support the states second largest source of revenue generation, tourism.\(^{33}\) The discussion with the local architect was greatly about the process of participatory design. We worked to identify the role of an architect in the process. We reached the consensus that it is the architect’s job to push the thought of relationship of spaces not necessarily the aesthetic of the building.

With these things in mind a second trip was made to Payong to work on the design and to attempt to cost the house. The meeting of consisted of some of the same members as the previous meeting with some new additions as well. This time we had a Panchayat member, an additional master carpenter, and a local contractor as well. During this session there was discussion at length as to what sorts of spaces are utilized most in the typical village home. The decision was reached that the kitchen and covered outdoor sitting spaces are the most frequented spaces in a home. As a continuation of the topic the issue was raised about access to the different modules in different settings, either at night, in the rain, or in old age. With this in mind the design process started. The home ended up being situated north to south, with a washroom module, then the main living house, and the south side being occupied by the kitchen.

\(^{33}\) Chief Engineer of the State, interview, Gangtok, Sikkim, 6, May, 2013, at 11:00.
A “Pucca” Cottage

Many of the same factors about the house reached in the original meeting were kept with some slight alterations. The house is to be made out of Ikra to maintain the usage of local sustainable materials, but with the importation of some materials based on requests of the villagers to create a more durable, long lasting home. The plinth will be made of poured concrete using local stones as aggregate and sand from the Teesta River. The masonry wall will be constructed either with local stones or bricks, choice upon owners wish. The mortar and plaster for the masonry wall will be made of cement. The frame of the home will be made of timber either local if available or imported, most likely from Siliguri. The Ikra panels will be made from local bamboo, which is found in abundance. When asked, members of the Payong community preferred to have cement plaster as opposed to mud plaster for the Ikra panels. This is because cement is a more durable material that will require less maintenance. The ease of maintenance with local materials is sacrificed for having to tend to them less. The roof structure also contains two options. Traditionally it is made out of timber, but a sustainable alternative to timber would be bamboo. While bamboo is not as suitable for the house body frame because of the surface-to-surface connection of the round bamboo with the panel plaster, it would work well as rafters and purlins for the roof. The ready availability of local bamboo makes it a more sustainable and cost effective method to timber. The roof material will then be made of corrugated metal sheets, of which the government provides up to 30 in construction per family. An additional 30 can be requested to the Panchayat illustrating
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that there are double the recipients in the family, father/mother and
grandfather/grandmother. Any additional sheets would require purchase.

The room program is similar to the original design except with the addition of a
toilet in the guest room for ease of access within the roof of the main living house. The
layout of the main living house has also been oriented to encircle a large central
courtyard/outdoor sitting room. This space is a feature of the home as an extension of the
standard three to four foot porticos found in the standard Ikra homes around the village.
A traditional aesthetic reminiscent of those seen in ethnic Nepali and Lepcha homes will
be designed for the corridor that connects the central courtyard to the northern side of the
plot of land. The design will be a framed and carved wooden entry. The design is kept
simple to make it replicable by local carpenters who lack the skill to mimic many of the
complex carvings in the traditional homes. But it will be an inkling to a past cultural
heritage that they find worth preserving. Each module will be connected via informal
structures, made of bamboo columns and chitra roof sheets, to increase accessibility
during the monsoon seasons and any other rains. The work on the design itself has been a
complete collaboration with members of the community. In addition to this, it has been
opened up to public discussion in the Gram Sabha, giving the people of Lingee Payong
complete access to it.

Analysis of Practice and Implementation

In order to make the design feasible in real life, and to increase the potential for
the government to adopt the design in its housing schemes is to cost the house accurately.

34 Payong Informant 1, Participant Observation, Payong Village, Sikkim, 21, April, 2013
35 Payong Informant 2, Participatory Design, Payong Village, Sikkim, 28, April, 2013
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The government currently has four and a half lakhs allotted per RCC house given through their housing schemes. At the second meeting the cost was broken down as per each material used for the home, also including labor. However, the cost of each material was based on personal knowledge rather than the government sheet of rates, SOR. The cost for the main living house came out around four and a half lakhs, and the kitchen at around two lakhs, with a total of close to seven lakhs. A contractor is currently in the process of breaking down exact figures in terms of a cost estimate. Once that is received it will be the responsibility of the community designers to come together and start cutting luxury costs most importantly without compromising the structural integrity of the building.

Regardless of implementation, one of the most important factors of the design process was to instigate a conversation that had not existed among the community of Payong. Their mobilization is imperative for any progression they hope to gain. They both now have the experience of working together to examine and discuss their needs out of a home and have working connections to assist them if they find it is a project worth pursuing. Both the head of ECOSS and the contacted local architect have expressed interest and have volunteered their services where they may be appropriate. This coupled with a working design created by the community has created a solid foundation for any future work. The design itself embodies sustainability by utilizing local materials for the structure, local knowledge for the design, and local carpenters/people for the construction. The design works to bridge vernacular styles with modern design ideas and materials to provide a holistic and culturally relative home. The culture of the area is

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36 Chief Engineer of the State, interview, Gangtok, Sikkim, 6, May, 2013, at 11:00.
reflective of the objective reality, thus the architecture should act the same. When appealing to a greater audience there may have to be an effort to inform them about the sustainability and purpose of the design. If someone is choosing based off of solely aesthetics the choice is self-evident. However, if people are considering other aspects of homes, proper information must be provided about the building type, whether this is RCC or Ikra. Improper education and points of view such as classifying only RCC structures as “buildings” or “pucca” may be seriously misleading. If the project were to be redone, with the knowledge of the interest of the community, I would have planned to hold the first participatory design meeting earlier. In doing so, I would have allowed myself to hold more meetings and to potentially get a more complete design. The current design while, serving a strong purpose in mobilizing the community, it is still in an early stage, and requires further development for the possibility of implementation. Thus, starting the design process earlier may have allowed for that.

Conclusion

Initial preparation was to study architecture in relation to earthquake preparedness exclusively after initial background. However, the project concluded that architecture is a facet of the inseparable changing gears of rural life in Sikkim. This includes earthquake preparedness, the urban-rural relationship, the current economic situation, political involvement at a grass roots level, and cultural and environmental conservation and development. The study of housing became an issue under each of these related categories. The goal of the design process was to create a home that represented a more

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37 Lingmo Informant 1, participant observation, Lingmo Village, Sikkim, 27, April, 2013.
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holistic relationship between these facets. Currently there are limitations in housing due to an imbalanced power structure, where people are misinformed about the status of RCC housing and not included in government attempts at development. A home should provide a comfortable and safe environment for its inhabitants. It should cater to their needs and be reflective of its own context, both built and cultural. By instigating a public discussion about housing, it has provided a basis for the community’s built environment to be a reflection of the community itself in a sustainable, cost effective, and disaster prepared manner.
Appendix 1: Floor Plan
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Appendix 2: East Elevation

Appendix 3: North Elevation

Appendix 4: South Elevation
Appendix 5: NE Perspective

Appendix 6: SE Rendered Perspective
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