

**Revitalizing an Urban Homeless Community
in Hong Kong**

by

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Abstract

In Hong Kong 'Unemployed' and 'Homeless' are terms that are often used to refer to people who are marginalized from society, either because of high property prices and expensive rent, or government policies that are ineffective. Most of the "marginal" group are living outside. People avoid them, and the government tries to isolate them, so that they do not have much chance to re-integrate with society.

My thesis is based on the social circular economic theory and explores creating housing and community for the homeless population by utilizing an abundant local material: bamboo. The introduction of a bamboo forest in turn provides an economic infrastructure for community; while assisted design and build activities provide this "marginal" group an opportunity to participate in building their society.

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Chapter 1: Introduction

This thesis examines a marginalized group of people in Hong Kong and explores a potential solution in the form of an urban bamboo forest. Based on the report from Homeless Outreach Population Estimation (H.O.P.E), most of the “marginal” group are living on the streets or under the bridges. People stay away from them, and the government tries to isolate them, so that they do not have much opportunity to re-integrate with society.

In general, the typical solution from the Hong Kong government is to provide temporary shelter for the homeless people, but only for a few months, and only if the homeless people are successfully referred by social workers and accepted by a shelter. This strategy has been developed from the narrowest understanding of homelessness and does not fundamentally address the problem: It has failed to provide sustainable and effective solutions for homeless people. Understanding homelessness, housing insecurity and the relation to local social and economic structures are key aspects toward creating a sustainable solution for homeless people. (Kennett and Mizuuchi 2010, 111)

Research into the theory of Social Circular Economy suggests a new concept of community based on fostering relationships between the daily behavior of the homeless and the surrounding neighborhood, concentrating on common activities and mutual reinforcement. The new community supports a sustainable alternative model of dwelling and supportive services for homeless people. The existing community has a training center for the erection of bamboo scaffolding, and with the introduction of Bamboo cultivation, harvesting, production and recycling, the enterprise can

function in a sustainable way to serve local people and help generate a diversified community. Therefore, the new and local communities can become mutually beneficial.

The community in question lives under the elevated freeway in between the old district and new district in Shem Shui Po. This is a traditional gathering place for homeless people. The urban strategy is to introduce a Bamboo forest beside the Freeway as a form of buffer. Bamboo as a material source can provide building material for housing and workshops; while assisted design and build activities can provide the community members with an opportunity to re-integrate with society. It is a multi-phase project that begins with a bamboo nursery, forest, and small factory; local housing first and then eventually a skill training centre, commercial shops, recycling workshops, material shops, and a medical center. With a Social Circular Economy, the community is much more than a gathering space for the homeless; by building off of local resources, it effectively becomes an education and training centre for interested people. Ideally, building community structures and accommodations will instill a sense of security and belonging for the inhabitants. The Architect's role is to provide the necessary infrastructure design and technical assistance for the self-build components.

Chapter 2: Background

Homelessness in Hong Kong

Compared with other cities, Hong Kong has very high housing prices and expensive rents. There are many people in the society who cannot afford basic food, clothing, and housing. Therefore they have to sleep on the bus, in the streets or in 24 hour fast food restaurants.

Based on a report from The Homeless Outreach population Estimation in Hong Kong (H.O.P.E), there were 1127 “street sleepers” registered with the Social Welfare Department in the year 2017-2018, an increase of 51 percent since 2013-2014 (H.O.P.E 2015, 32). The most commonly cited reason for homelessness is the inability to pay rent owing to unemployment. Others said they could not find affordable housing, or find a place to live after being discharged from prison or other institutions. Of those registered from last year, 92 people said it was a ‘personal choice’. More than half of the 1127 registered “street sleepers” said they had been homeless for more than five years. Of these, 244 people said that they had been sleeping on the street for more than a decade (Ellie 2018, 1).

Socially Exclusive and Inclusive

Before the 1990s, in the industrialized economy of Hong Kong, the homeless issue was not considered to be a serious problem. It was invisible to society and policy makers, and homeless people were often characterized as morally deficient or aging individuals. Flowing from the financial crisis in 1997 and the economic problem caused by the SARS flu outbreak in 2003 and now COV-19, unemployment has been growing rapidly. With this there

has been an increase in poverty and inadequate housing, all making the homeless issue quite visible. In response to the homelessness issue there have been many institutional and policy responses from governments, and many non-governmental organizations (NGOs) and grassroots organizations have lobbied on behalf of the homeless. As a result, the number of “street sleepers” initially decreased. But it did not last long. With the economic downturn (since 2011) income disparities that have consistently widened, job insecurity, issues of access to affordable housing, and inadequate welfare systems, the homeless population has increased every year and now includes younger, better educated men and women (Kennett and Mizuuchi 2010, 112).

In responding to the context of globalization and rapid economic development, the Hong Kong government's strategy for economic growth has been reconstructed toward a post industrial, service-oriented society. Based on the Hong Kong annual report there has been a continued rise in the share of the service sector GDP from 73% in 1988 to 86% in 1998 and 92% in 2008. This causes labor intensive production to become very high and increases income disparities between low-income and high-income people. Meanwhile the wage gap between skilled and unskilled workers has also grown.

In response to the increase of homeless people living on the street and concerns that homeless people are getting younger, the three-year plan was implemented to help street sleepers. NGOs were founded by government, and have played a central role for temporary hostel accommodation and services; such as arrangements for job placement, fund applications, counselling, assistance with accommodation

and advice on employment. There are about seven street temporary shelters for street sleepers with a maximum of six weeks stay on a self financing basis, and five urban hostels and temporary shelters operated by NGOs with a maximum of six months of stay, and emergency shelters. In order to help more homeless people, these services and temporary accommodations have increased for many years, however the number of homeless people remain high. The reason for this is that temporary shelters may help people who are homeless in the short term, but it does not help much for those who are homeless in the long term or are having mental issues (Kennett and Mizuuchi 2010, 112).

Types of Homeless and Considerations

Based on the report from the H.O.P.E, the definition of Homeless is not entirely clear. For example what about people living in poor conditions, do we also consider them to be homeless? In Hong Kong, there are a lot of people living in rooftop shacks, cage houses or subdivided rooms, which are often illegal constructions. In these places too many people share one toilet, suffer from bed bug problems and safety issues. These issues not only affect their living quality, but also affect their social activities, and over time people may develop mental problems. There is another category of people called potential homeless, and those people are often referred to as people who do not have a stable job or no savings to maintain their life. Some of them are overburdened with rent, and if any economic shock happens to them, they may not be able to afford the rent and will become homeless (Siqi et al. 2018, 10).

In East Asia the dominant understanding of homelessness is 'rooflessness', which is identified by ETHOS (The European Typology of Homelessness and Housing Exclusion) as the most extreme classification of homeless people according to

their living situation:

- Rooflessness (without a shelter of any kind, sleeping rough).
- Houselessness (with a place to sleep but temporary in institutions or shelter).
- Living in insecure housing (threatened with severe exclusion due to insecure tenancies, eviction, domestic violence).
- Living in inadequate housing (in caravans, on illegal campsites, in unfit housing, in extensive overcrowding) (Kennett and Mizuuchi 2010, 114).

Summary

Social exclusion and housing insecurity are always present in the day to day lives of homeless people. In Hong Kong rehabilitation services and temporary shelter provisions for homelessness have increased in recent years. Implementing more inclusive social services can mitigate insecurity and homelessness. However, this strategy has been developed from the narrowest understanding of homelessness and will not fundamentally solve the problem. Up to now, it has failed to provide sustainable and effective solutions for homeless people. Even though there has been a reduction in the number of street sleepers, recognition of housing insecurity is often neglected. In Hong Kong many people live in cage homes or subdivided rooms, and it seems like people in unstable economic and social situations often shift from one form of homelessness and insecurity to another. Understanding homelessness, housing insecurity and the intrinsic relation to social and economic structures are the keys to creating sustainable solutions for homeless people (Kennett and Mizuuchi 2010, 117).

Chapter 3: Data Analysis

Homeless Characteristics and Opportunities for Design

In Hong Kong most homeless people are over 45 years old and single, and about 80% of them work as labor because of a level of low education. They do not have any friends, or family member support and so they cannot afford rent and are generally living in a very poor environment (Hong Kong Poverty Situation Report 2018, 26).

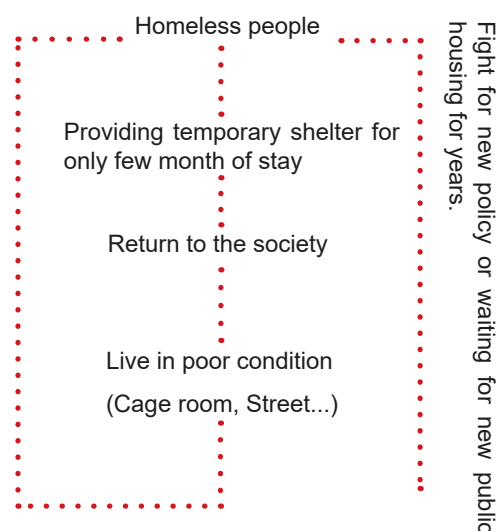
Thus it can be seen that a lack of affordable housing is a common problem for low income people. Many of them do not have the proper skills to hold a stable job, and without proper skills people are easily affected by economic fluctuation. In order to offer a homeless group a stable and healthy environment in which to live and work, a long-term community school is needed, so that people will have enough dedicated time both to re-socialize and update their skills. By providing affordable housing for different sizes of families, there is a compelling reason to stay in the community and adapt to a new living mode (Hong Kong Poverty Situation Report 2018, 32).

The Government Solution vs A Proposed Solution

The typical solution from the government is to provide temporary shelter for homeless people, but only for a few months. This happens only if homeless people are successfully referred on by social workers and then accepted by a shelter. However most homeless people are isolated from society for a long time, and that makes it difficult for them to get along with neighbors in a shelter. Furthermore in

terms of living conditions, some shelters are unsanitary with bedbugs and other pest infestations. The government does not provide any social services to the shelters (Kennett and Mizuuchi 2010, 97).

Some people may decide to fight for a new policy or wait for public housing, but the amount of waiting time and lack of social support is definitely a challenge. Thus it can be seen that government policy and solutions cannot really solve the homeless problem at its root cause, because they fail to recognize the existing social and economic structure from the homeless point of view and do not have any supportive social services associated with re-integration.



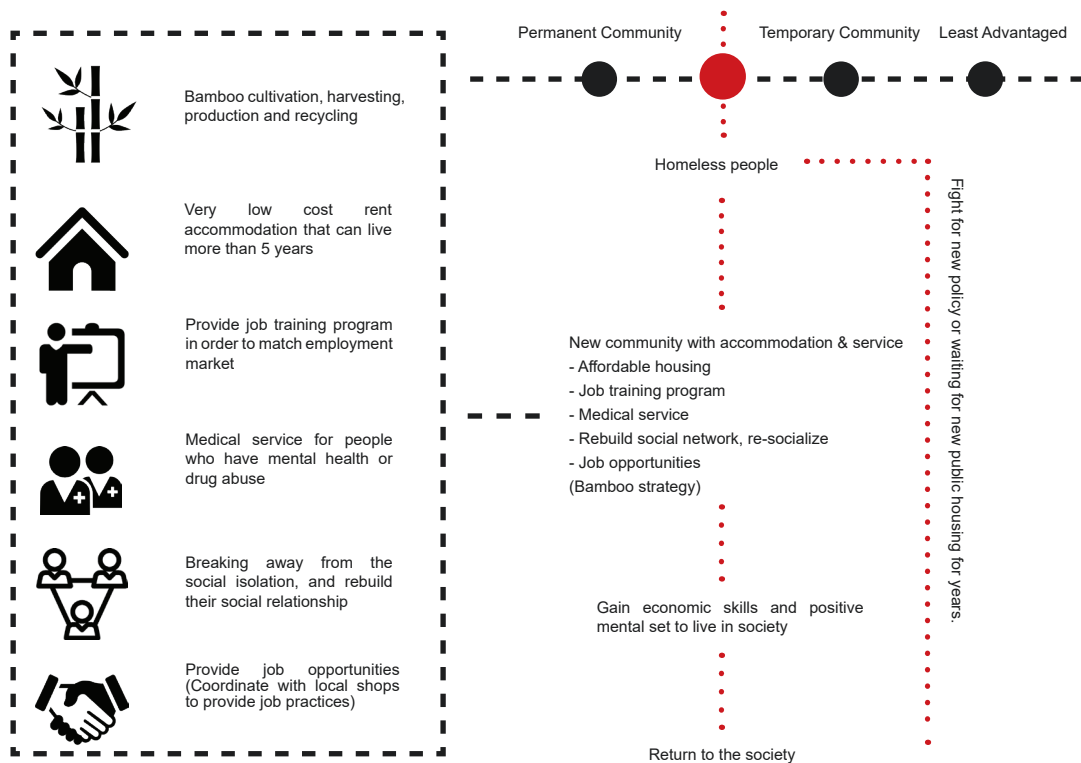
The government's typical solution

To avoid this vicious circle, we have to create a community that can provide a sustainable living model for homeless people. In order to do that we need to provide long-term sustainable living accommodations with associated supportive services, that are linked to the existing social and economic structure. In this way, homeless people can begin to deal with their individual conditions (such as low income) and persistent

issues (that may include drug abuse or mental illness); in order to live a more stable and hopefully productive life.

By providing low rent accommodation for a minimum of five years of stay, people will have enough time to rebuild and stabilize their social lives. Supportive services can also provide job and skill training in order to help them match better with the employment market, and develop their own skills. My hypothesis is that with the introduction of bamboo cultivation, harvesting, production and recycling (as a material sustainable strategy) the community will establish the necessary economic and social support needed (Kennett and Mizuuchi 2010, 36).

As a result, this community can offer an environment to reduce rejection from others and create a positive friendly atmosphere; giving opportunities for self-help toward finding (or recovering) a sense of labor and responsibility.

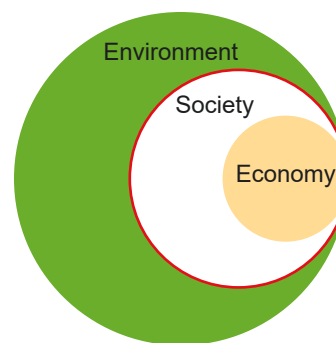


Proposed solution for the homeless In Hong Kong

Chapter 4: Theory and Methodology

Toward the Social Circular Economy Theory

The circular economy concept can be defined as a model in which the flow of material, resources and energy are related in loops to minimize the environmental impact during the whole life-cycle of products and service. It is different from the traditional or linear economy models that do not have life-cycle loops. The sustainable design method is closely linked to circular product design. Reuse, recycling and reproduction are major tasks to reduce negative impacts during the product life-cycle. In essence, the circular economy is an operating model to ensure that the economy does not harm the planet and in fact benefits the environment in a more effective way.



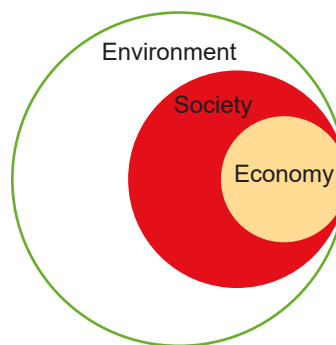
Circular economy

In general, the key to social enterprise is to focus on making a social impact just as much as making money. The aim is to create a positive effect by tracking social problems and improving opportunities for under privileged people (such as the homeless) and strengthening communities (Robinson 2017, 6).

Social enterprise is different from charities or non-profits organizations. It is not reliant on continued funding. Based on the report from Social Circular Economy Guild, a good social enterprise typically has the following characteristics:

- A clear social mission
- Generates a majority of income through trading goods or services
- Reinvests a majority of their profits into their mission or organization (Robinson 2017, 5)

The Report of the Social Circular Economy Guild suggested that it should be clear what groups of people social enterprise support, and they are often called beneficiaries, disabled, homeless, living in poverty, long-term health conditions, refugees. In essence, social enterprise is an operating model to ensure that economy does not harm society and in fact benefits society in a more effective way.

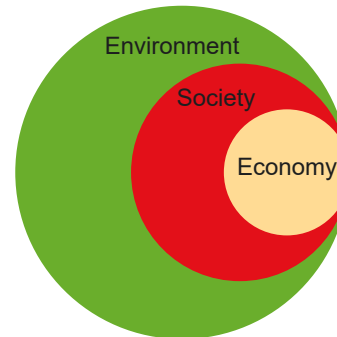


Social enterprise

The social circular economy combine the two types described above. This is where organizations operate commercially within the circular economy and also have a clear social mission. The social circular economy recognizes that the global system should be represented by a thriving economy embedded within a rich society. It also recognizes that more local and distributed solutions (or value creation) is the key to achieving sustainability. In essence, the social circular economy is an operational model to ensure that the

economy does not harm society or the environment and in fact benefit society and environment (Robinson 2017, 14).

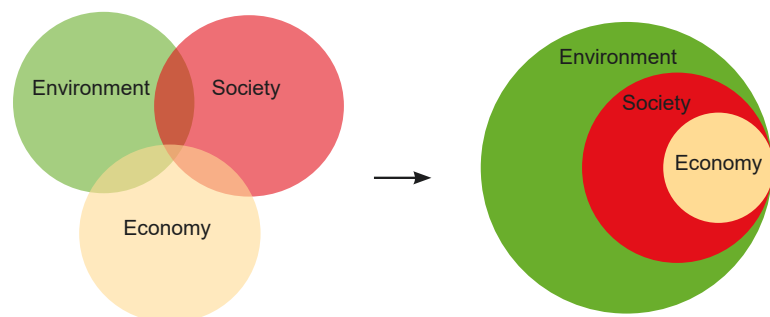
Society, Environment and Economy (win-win-win situation)



Social circular economy

Circular economy strategies are able to generate and capture the value of the product while preserving the environment; by combining it with social enterprise, it will transform the product value into social value as well as economic profit.

- The society will win in terms of reduction in inequalities and support for the disadvantaged with commensurate reduction in costs for the government.
- The environment will win in terms of far lower emission and waste.
- The Economy will win in terms of large net material saving and satisfying employment. (Robinson 2017, 11)



Toward social circular economy - from overlap to nesting loops

The figure above illustrates the value of the prevailing system and what should be done to move forward. The diagram on the left indicates a core value where environment, society and economy should be treated equally. However the reality is that most of the time the economy comes first and as a result the environment will suffer and societal issues go ignored. The diagram on the right suggests that environmental values should be the most significant aspect of decision making. Choosing materials and methods that cause the least harm to the environment also serves the needs of the people. Society comes second, in order to create a healthy and happy community. As these two core values fall into place often the economy will flourish as a result (Lindsey 2017, 55).

Low-Income Bamboo Community in Brazil, Case Study

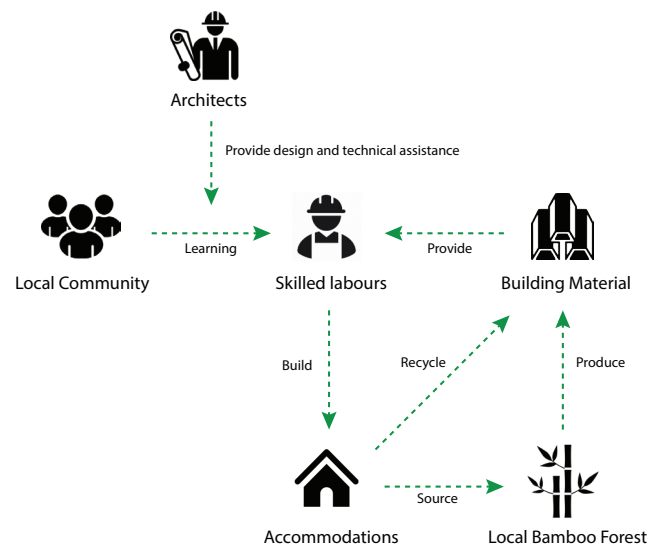


Low-income bamboo community, 2004; photograph by Nelson Kon (Wang 2018)

This case study illustrates a social circular economy. The community is located on the Brazilian coast, and it is a multi-phase project that includes a library, a computer room,

office space and a bakery from 2004. The community not only serves as a communal gathering space for the local small town, but it is also a social development project that was built for and by a local low-income group. CRU! Architects provided the design and technical assistance for local groups to build. The project started in 2004 and its first completed building was the community center, built of bamboo and rammed earth from local sources.

This project was proposed to facilitate educational training for the local community; to improve their bamboo techniques and to build community infrastructure. The community decided all the programs and component parts of the building, which were built at different times over the last 10 years (Wang 2018).



Example of the Circular Economy using bamboo as a sustainable building material

Kowloon Walled City, Case Study

Kowloon walled city was a self-organized city without planners or architects. The city operated within its own system, where the elements were constantly changed

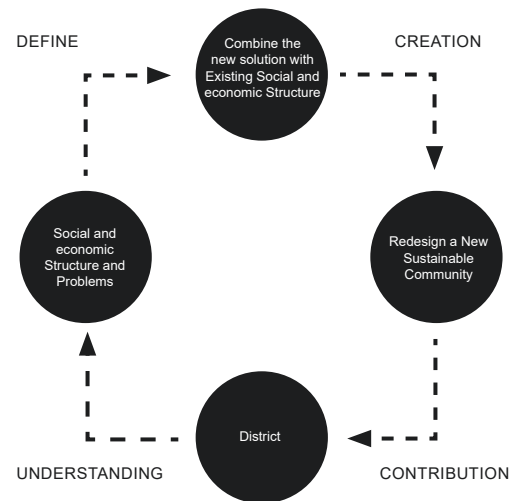
and adjusted in accordance to community needs. It also presented an example of a social enterprise generating its own economy within the wall (Lamobt, 2017).

All the businesses in the community were small-scale and local. There were no globalized shops found within the wall. This somewhat unlawful environment allowed small business to survive. It was known for its high number of unlicensed merchants and doctors. People who had skills were able to start their own business without government control. The city was also known as the city of darkness, because there were many criminal activities and illicit businesses, but that only tells one side of story. The neighborhood was remarkably productive, there were hundreds of tiny factories, private businesses and workshops throughout the city. The products made and services provided inside of the city did not only serve the local people, but for the most case, they provided alternative services to Hong Kong society in order to generate its own economy (Suenn 1993, 58).



Kowloon walled city, 1989; photograph by Greg Girard (Lamobt 2017)

The Strategy for Social Circular Economy Method



Social Circular Economy design method

In order to create a sustainable community, the concept of the Social Circular Economy needs to be applied to a community. The idea is to focus on how to take advantage of the existing conditions and at the same time add new value in the fields of commercial activity, social activity, and public relationships around the neighborhood. This means not only economic production but at the same time contributing back to the local community. In this project the introduction of Bamboo cultivation, harvesting, production and recycling can function in a sustainable way to serve local people and help generate a diversified community.

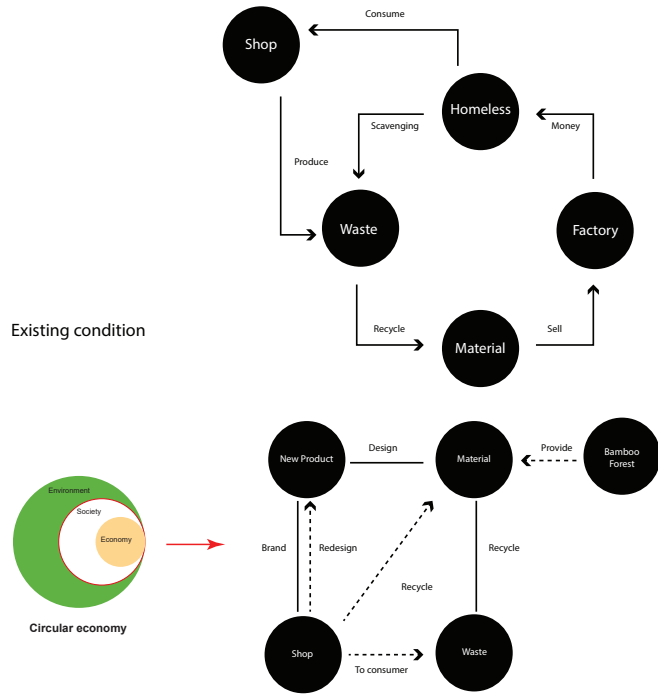
In order to achieve the circular system, one needs to identify and consider the needs for the local community and the surrounding neighborhood. Consider the economic structure, social structure and city structure from the macro to the micro scale: public relationships, social activities, commercial activities, and local behaviors. It is important to think about the designed community as a part (or related to)

of the local community. In being related to the surrounding context, the new community enterprise can not only provide support functions for the inhabitants, but it can also contribute to the larger society.

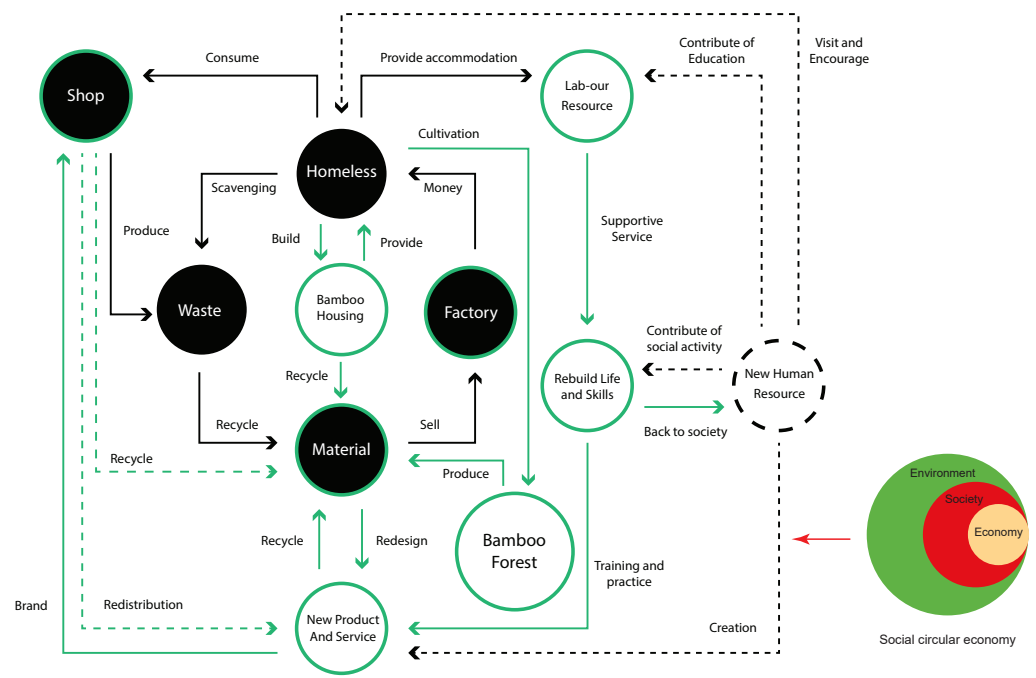
The Circular Community Model

Based on the report from the H.O.P.E scavenging is typical work for homeless people. They pick up valuable items off the street and sell them to the waste factories. Some of them also work at secondhand markets or local shops. The intention of the circular community model is to take this situation as a sample for formulating a new type of model that can be adapted at multiple locations; in order to solve the homeless issue at the larger scale in Hong Kong (H.O.P.E 2015, 3).

The diagrams below show the idea for a new bamboo community concept. They indicate the relationship between the homeless daily behavior, the surrounding neighborhood and common activities. Ideally the new and local communities can become mutually beneficial. The circular design concept diagram includes four fundamental circular models which are: an existing living model for the homeless, a new living model for homeless, a product circular model and a bamboo housing circular model. In the diagrams there are a lot of elements that generate and synergistically contribute to other elements. The concepts show how resilience, sustainability, and long lasting values are embedded in the new community.

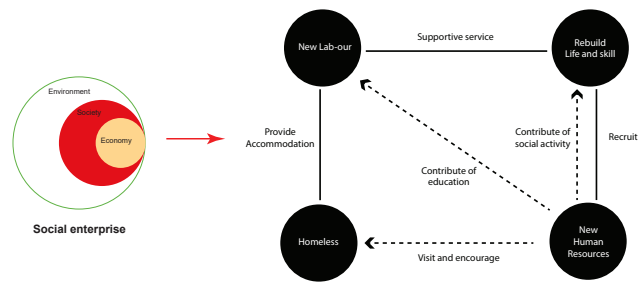


Circular Product model based on Circular Economy

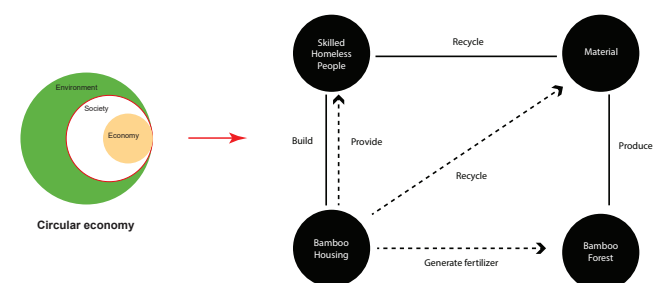


Circular community based on Social Circular Economy

- Existing
- New intension
- - - New output



New living model based on Social Enterprise



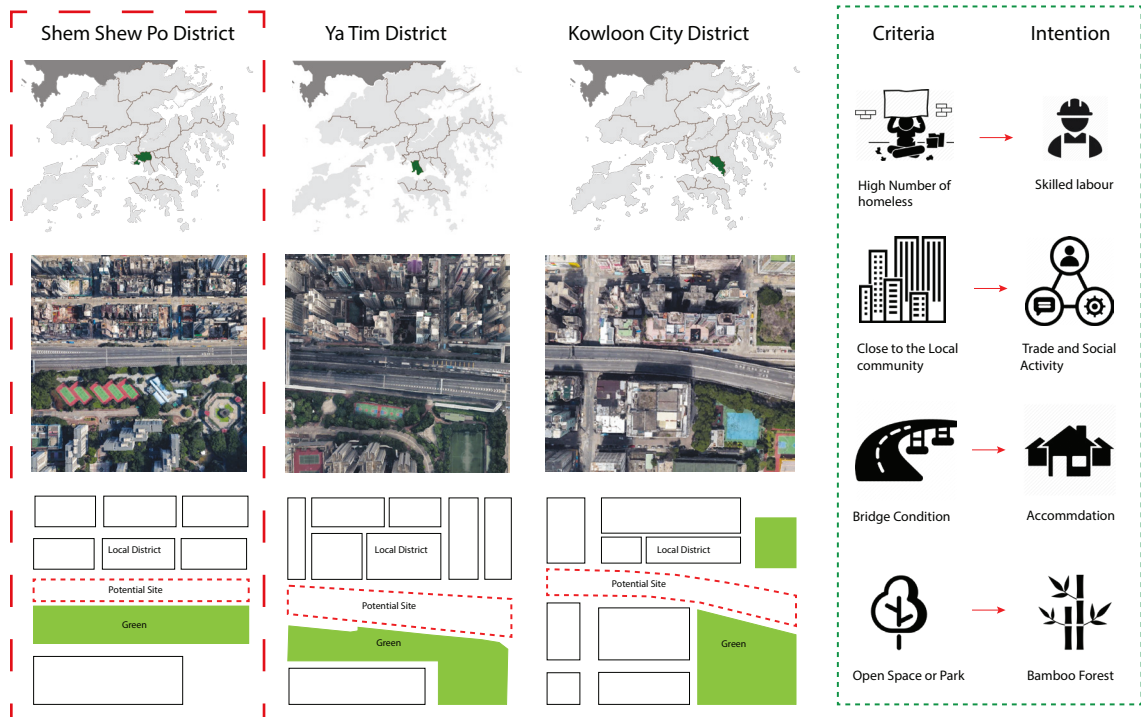
Circular bamboo housing model based on Circular Economy

Circular Community Model

Chapter 5: Site Analysis

Strategy for Site Selection

To respond to the circular community model and to consider the homeless problem on a large scale in Hong Kong, some specific criteria need to be met for site selection. The first criterion: the selected site needs to be in an area with a high number of homeless people. The second criterion: the site needs to be close to the local community so that homeless people will have more opportunities to usefully participate with society. The third criterion: the site needs to offer the opportunity where homeless people can live comfortably and the public can accept them easily, a place with district boundaries but not isolated. Freeway sites fulfill this criteria (as below). The fourth criterion: the site needs to have open garden land available for the bamboo forest as a material supply for future building activities.



Potential sites and criteria (base map from Good Earth 2019)

Shem Shui Po District (SSP) Description



Map of Sham Shui Po district, Hong Kong (Google Maps, n.d.)

Shem Shui Po is an area of Kowloon situated in the northwestern part of the Kowloon Peninsula, which is the poorest area in Hong Kong. It is also one of the densest and most vibrant neighborhoods in Hong Kong. It is a convenient place filled with old shops, electronics, clothes and second hand markets where people can buy and trade cheap products.

Many types of migrants come from rural China, along with working class families and Seniors (with a very high percentage of elderly). Many of them live in cage homes, subdivided flats, and on the street. According to the Hong Kong's biannual census, every year Shem Shui Po has the lowest per capita income of the 18 districts in Hong Kong (2200 HKD). In addition, based on the report from Homeless Outreach Population Estimation (H.O.P.E), there are about 565 homeless people living in this area which is 35% of the total homeless in Hong Kong (H.O.P.E 2013, 44).

According to the Hong Kong Poverty Situation Report, the Shem Shui Po district has usually been the poorest neighborhood in Hong Kong (from 2000 to 2018). The report does not include any data from homeless people, due to the challenges of counting the homeless population; as most of them are not covered by government policy (Census and Statistics Department 2018, 73).

About 20% of the population in SSP are living under the poverty line, and 30% population who are elderly. Normally this group of people do not have a job or any income, and they can only use their savings to maintain their life. Twenty percent of the population are working in the labor force

(mainly because of low education) and 15% are unemployed (Hong Kong Poverty Situation Report 2018, 76).



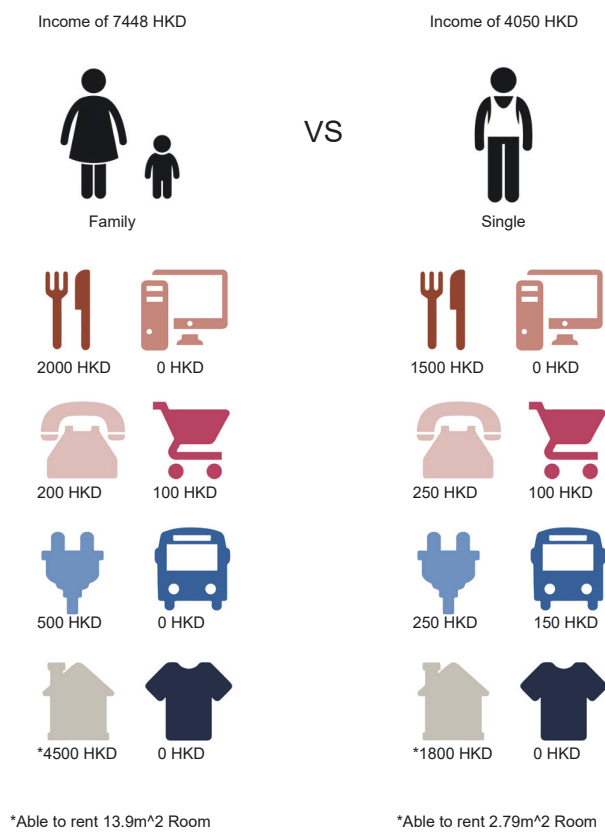
Local living statistics (under the poverty line)

For the people who are under the poverty line, the average income is only 2900 HKD, which is quit low compared with basic living costs of 4050 HKD. In addition, the Shem Shui Po district is also facing a serious growth in aging population, according to the population census in 2016, the average age is around 49 years old.

A reporter from the South China Morning Post interviewed two different groups (family and single) in the SSP. He concluded in general that 50% of people's total income is contributed to the house rent. One housewife (who has two children with 7448 HKD monthly income) said that after paying for the rent she cannot buy any toys for her children, cannot go restaurants and does not have enough savings to see the doctor when they get sick. One skilled labour (who lives alone with only 4050 HKD monthly income) said he

does not have enough savings to buy any clothes or shoes, as all of his money is already spent for his daily needs (Hong Kong Poverty Situation Report 2018, 78).

Overall, from the data and interviews we can conclude that Shem Shui Po district has a very serious poverty problem. In order to survive with a low income, many people are living in cage houses, subdivided rooms and on the streets. It also helps explain why about 35% of the population are homeless, living in this district.



Average living spending/per month above the poverty line (Data from Hong Kong Poverty Situation Report 2018)

The Existing Homeless Community Under the Bridge (target group)

In SSP, there are different types of living space that are built under crossings, footbridges and railways. They are often situated on platforms to protect themselves from humidity or insects. They are usually built against pillars that can be used to support their shelters. Sometimes people use umbrellas, plastic and strings to patch their roof and to protect themselves from heavy rains or leaks. Other supporting elements include underused infrastructures (that are owned by government) which are used for water, electricity and services for people without homes.



Self-made market, 2018; photograph by Siqi Huang (Siqi et al. 2018, 34)

This self-build community process usually starts with the construction of a single living space. Then a common space quickly develops and may include a table and chairs. Once the common infrastructure is built, it will attract people from outside of the community, like people without a home or elderly people from the neighborhood who visit to drink tea and talk (Siqi et al. 2018, 50).

This self-build community in SSP varies from being built on a temporary basis to being quite permanent. There are three groups of people who are using these spaces.

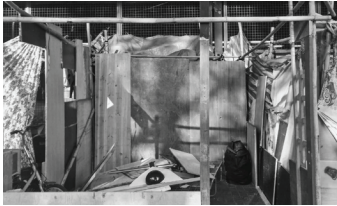


Custom designed car as shops and carts as shortage space, 2018; photograph by Siqi Huang (Siqi et al. 2018, 34)

The first group of people are temporary users. They are normally without homes and live a nomadic lifestyle: such as Street vendors, workers in the building industry and the elderly gathering for tea and chat. Sometimes, builders in the building industry use the space as a day office, usually during the period that a specific construction site is ongoing. Street vendors create temporary sale spots for their wares with a newspaper spread out in the ground. The trunk of cars and carts are used both for demonstration and for storage.

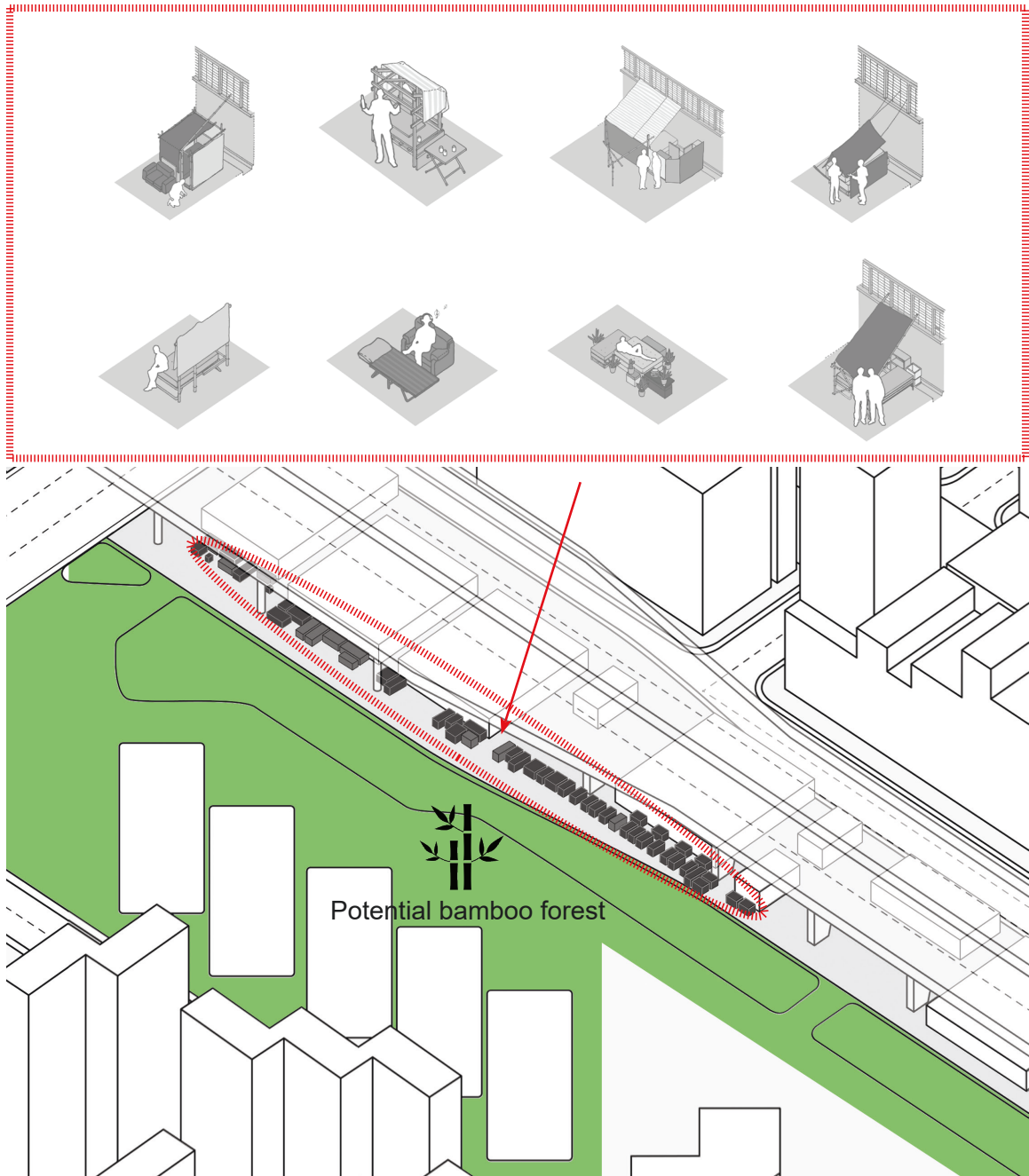
Similarly, elderly people use the common public spaces that are created by people without homes.

The second group are semi-temporary users. Those people are usually local inhabitants of SSP who rent a subdivided room during the winter time and come back to the temporary home under the bridge in summer, since subdivided rooms are too hot and too small to stay in. In the meantime, they can also save months of rent for the summer period.



Temporary bed and sleeping room, 2018; photograph by Siqi Huang (Siqi et al. 2018, 34)

The third group are the permanent users. This group mainly consists of homeless people or migrants from other areas. Because they are the most sedentary compared to the other groups, they build the most permanent spaces. Since they do not have much opportunity for getting shelter and support from the government, those people are normally the strongest in self-organizing their common space and having rules. Compared to other groups, they make a more intensive use of the electric and water services that are available under the bridge. Because they are using the space in a more elaborate way than the more temporary users, usually their houses are the most developed.



Existing homeless community under the bridge and potential green space for bamboo forest, Hong Kong (Siqi et al. 2018, 9)

Site Selection Summary

From a physical location point of view:

The site is located in the middle between the new district and the old district of SSP. The public can easily access the site every day. It will help homeless people to build their social network and raise public awareness. There are plenty of green spaces that can be used to grow bamboo as sustainable material for housing and infrastructures. The elevated highway provides basic shelter.

From a society point of view:

The site itself is historically a place of homelessness as seen by the local people. It is the best place to build a community in this area. By creating an interesting design and useful programs, the public can be encouraged to visit, and come to better understand and accept the homeless situation.

From a public point of view:

As this homeless neighborhood has existed for a long time, the public have gotten used to this location. If a community is built elsewhere, the new neighborhood may give local



Shem Shui Po district sky view (base map from Good Earth 2019)

opposition. It may also affect government consideration for future development.

From a homeless point of view:

There have been many homeless people living in this location for a long time. They do not want to move to a new neighbourhood. Many longer term inhabitants who live here already have established social relationships with other homeless people in the neighborhood. It is easier for them to stay where they are.

From a commercial point of view:

The local neighborhood has very low prices for products and materials compared to other areas and the location itself has very low property values, which are not attractive for most developers to build housing.



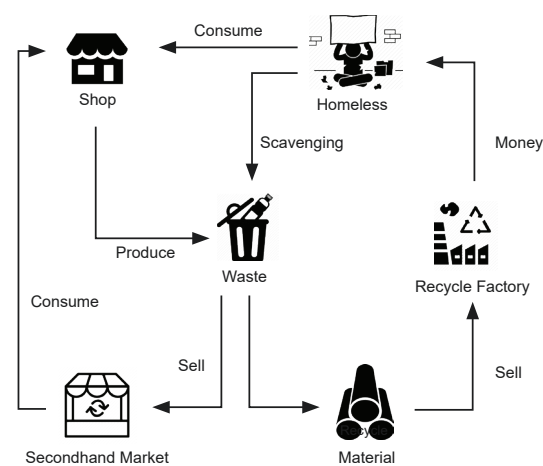
Shem Shui Po streets in relation to the site (base map from Good Earth 2019)

Chapter 6: Program Development Based on The Circular Community Model

Homeless Living Mode in Shem Shui Po

As mentioned, scavenging is major work for homeless people in Shem Shui Po. They pick up recyclable garbage off the street and sell it to the recycling factories. There are many shops in the Shem Shui Po district, which continue producing waste and materials everyday, which the homeless people can then collect and sell.

Homeless people also pick up items of value from the waste they collect and sell them in second-hand markets. They put their wares on the ground for sale, and people can find very cheap prices here. Furthermore, people who buy second-hand items can also repair them and bring them back to the market to sell them for profit. Therefore, the second-hand market is very popular and most social activity happens here (Kwok-Wai, 2013).



Existing living mode for homeless people

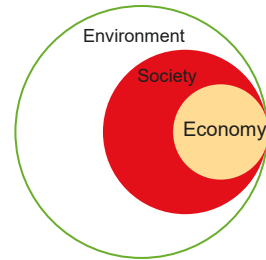
Circular Community in Shem Shui Po

The site makes a division between the old district and the new district. My idea is to use the Circular Community Model to build a self-sustaining homeless community integrated with the surrounding context. This new community can form the basis for approaching the homeless problem in Hong Kong with a new development model.

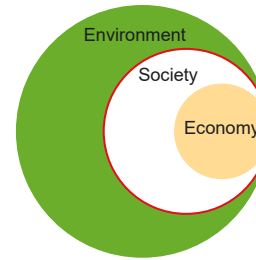
In order to help homeless people rebuild their skills and social networks, the circular community not only provides sustainable bamboo housing, but also provides material shops, design studios, the bamboo forest and other commercial elements as supportive services and to invite surrounding neighbors to join (see diagram p.31). Through this new community model, we can start to blur the boundary line between homeless people and the public in SSP, toward developing an integrated sense of society.

Based on the social structure, activities, the daily routine of the homeless and the site condition in Shem Shui Po, there are three major circular models proposed by using the Circular Community Model as a basis; these are a new living model for homeless people, a product circular model and a bamboo housing circular model.

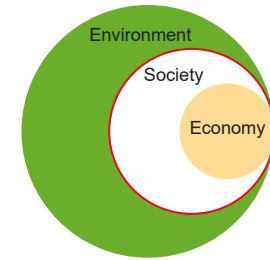
The Master Circular Community diagram combines the three into a blueprint for a new sustainable community development model in SSP.



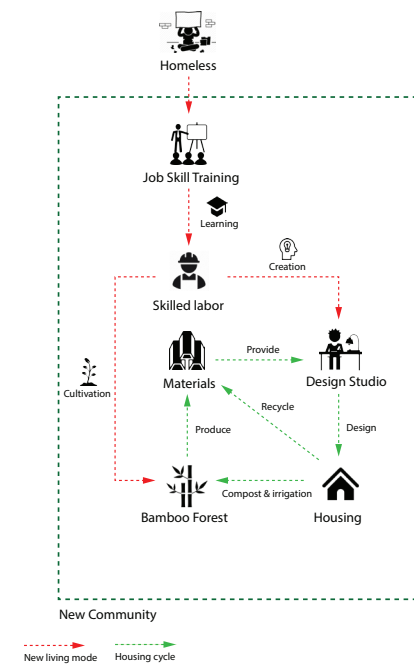
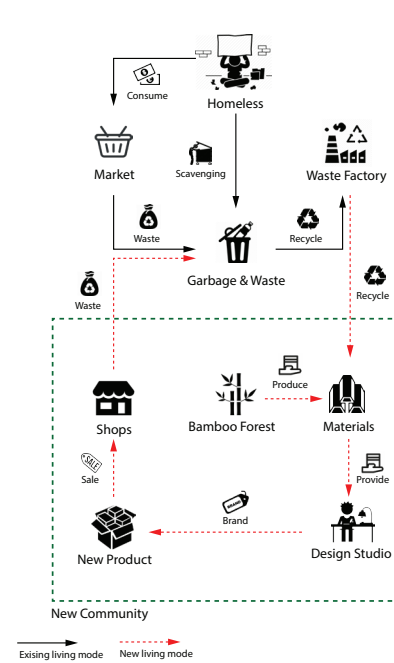
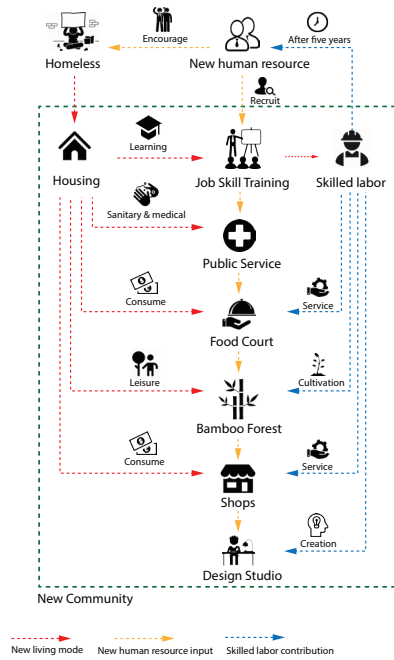
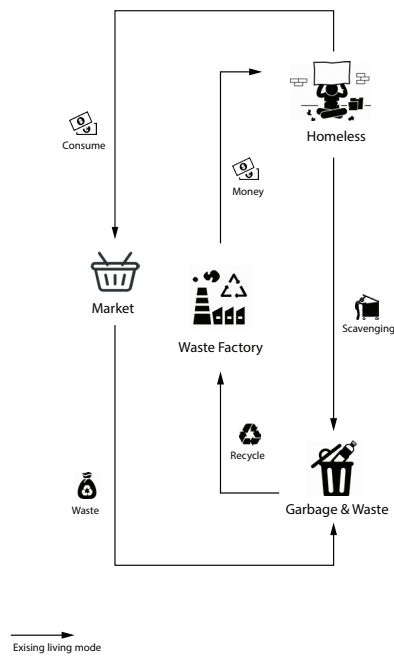
Social enterprise



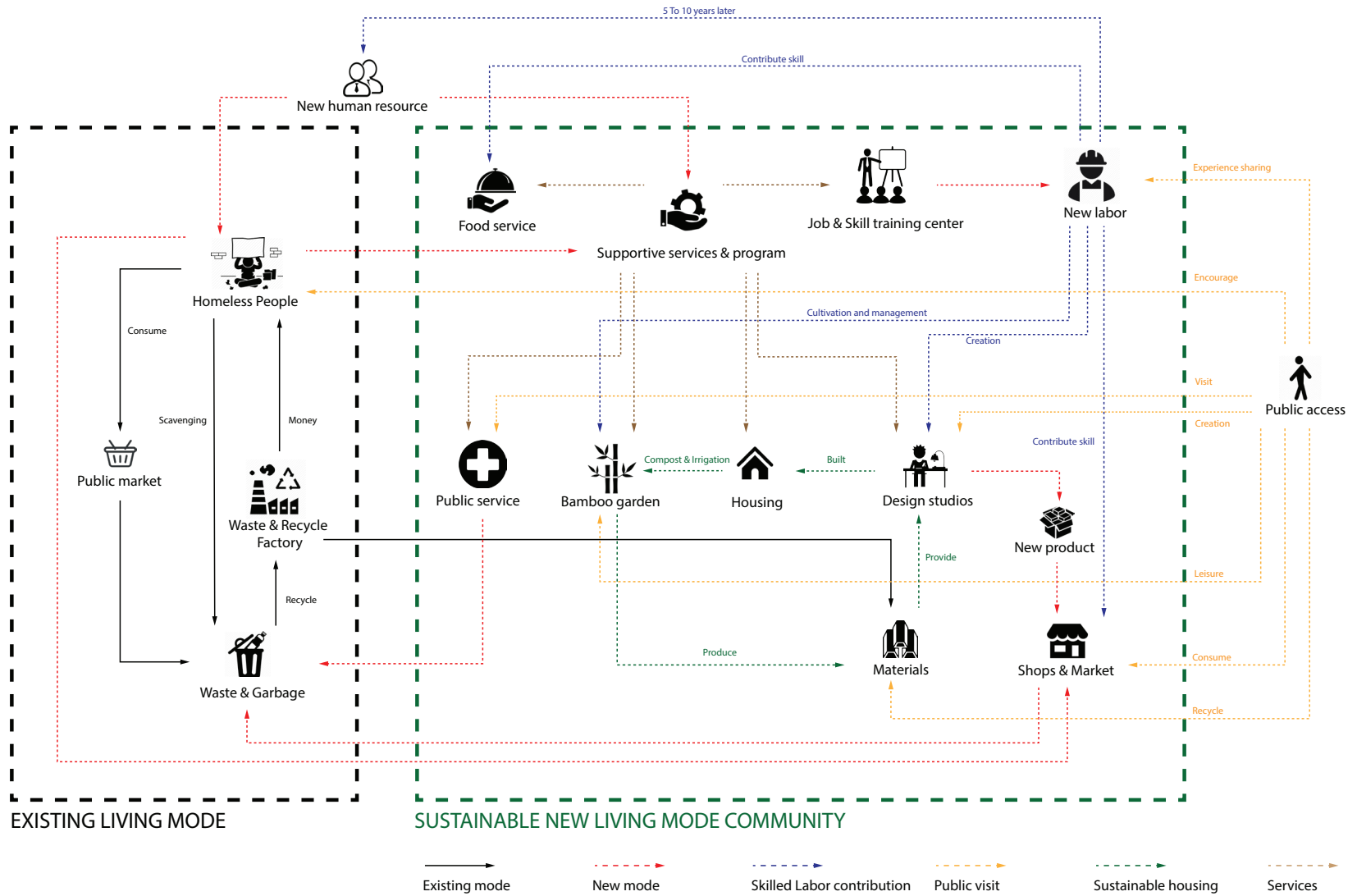
Circular economy



Circular economy



Circular design concept diagrams (Existing living model, New living model, product circular model and Bamboo housing circular model)



Master circular design concept diagram

Inclusion by Design

Architects can help to solve major homelessness problems by inviting homeless people to participate in the design process. By introducing the building technologies and the materials, the architect is inviting the community in for the housing creation phase, which is very important for social inclusion. By participating in making decisions about the design of the housing, the inhabitant's sense of belonging can be enhanced. It can increase the feeling of security that homeless people are often lacking, and remove barriers between the communities.

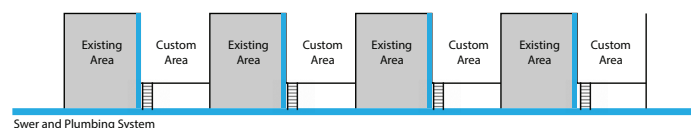


Quinta Monroy project in Iquique, 2003; photograph by Tadeuz Jalocha (Quinta Monroy 2013)

An example of the incremental idea is housing for the homeless in Iquique. The building of the houses involved homeless people who were in hopeless life situations. They did not have a place to live and little perspective for the future or job skills. These people were invited to participate in the design process for building their own housing, and all residents could take part in building workshops that were facilitated by the Architects Elemental. All the houses came with a manual for possible ways to expand using standard building material, in order to avoid any extra cost (for expensive material). For the homeless people, helping create their own housing can give them a sense of security. In other words the involvement of the homeless people in the construction became a form of therapy for homeless insecurity (Rybka and Brudnicka, 2018). The use of solid cores with flexible space between has usefully informed the design of the SSP project.



Quinta Monroy project in Iquique, 2005; photograph by Cristobal Palma (Quinta Monroy 2005)



Section of incremental housing

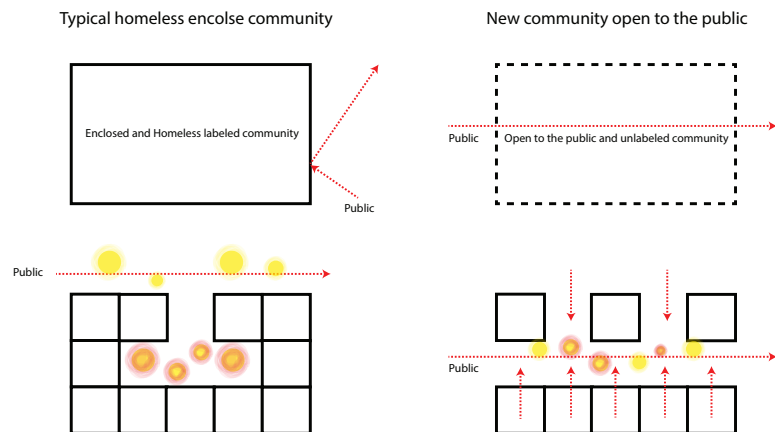
The Proposed Community for the Homeless in SSP

In order to design a healthy sustainable community for the homeless, it is critical to create a positive friendly public environment and help homeless people rebuild their social relationships.

Most homeless communities have been designed as an enclosed form, such as the Kowloon walled city. It was an inter-community for homeless people, which provided limited opportunities for them to interact with the public. Therefore, the public was not willing to understand them, and so they were labeled as “Homeless” and detached from society. The only difference is that they became visible when grouped in one area called the homeless community (Suenn 1993, 58).

In order to avoid this problem, we need to coordinate with local social work organizations and evaluate homeless people to define our target group. Once they are evaluated as not posing a danger to the public, the community can be designed and open to the public. Based on the report from Homeless Outreach Population Estimation (H.O.P.E), there are about 565 homeless people living in the Shem Shui Po district, and about 200 of them are living under the bridge (H.O.P.E 2013, 44). Once the new community is designed, every incoming homeless resident shall be evaluated and registered under the local social work organization. By giving the public access to the community it can offer the homeless a chance to interact with the public, and also can help them shed the label of Homeless. In other words, the homeless will become a part of the public, and the new community becomes a part of local social and economic systems.

Location Program: Site Strategy



Typical community strategy vs new community strategy

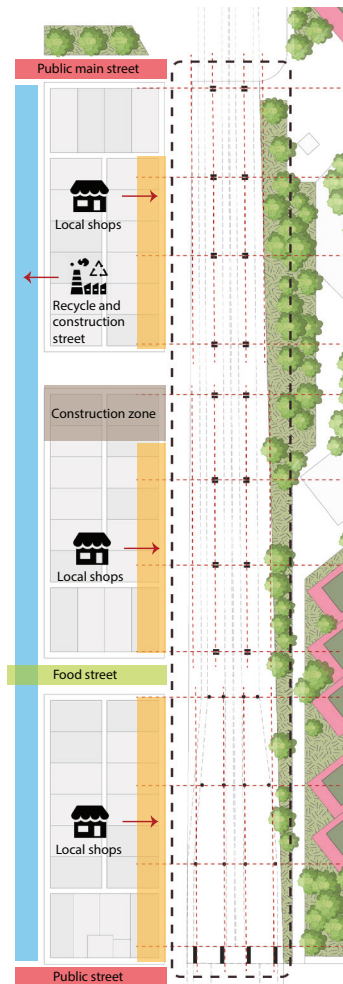
In order to engage the public, the community should be designed as part of the public daily experience. The community should provide local commercial elements such as stores, restaurants, and recycling and design studios, so that the community can attract the public easily. Furthermore, by putting more shops and other commercial elements in the community, social activities will happen that offer homeless people more opportunities to engage with the public.

In response to the bamboo housing circular model, the two underused tennis courts need to be repositioned elsewhere and replaced with a bamboo forest, to support the community for new material and building need (See diagram p.36). There are two acres of potential lands near the site, which can allow over 2000 bamboos trees to grow. Ecologically, the bamboo forest can prevent soil erosion, and act as a buffer against future storms and floods in a low-lying coastal area. Bamboo can also help to sequester carbon since the site is next to the freeway. "The research has demonstrated that bamboo can absorb as much as 12 tonnes of carbon

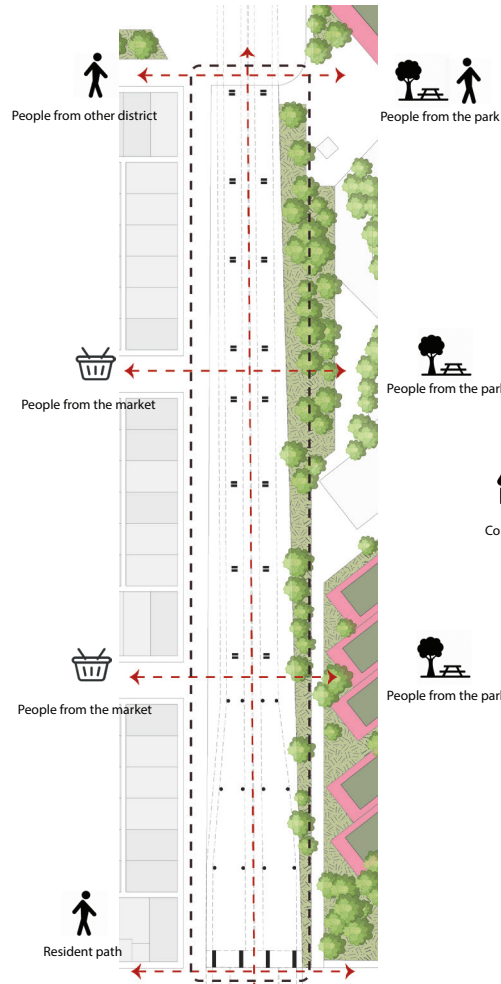
dioxide per hectare per year (approximate 2.4 acres of land), giving the city a potentially crucial role in stabilizing the city atmosphere. Bamboo absorbs carbon dioxide and releases 35% more oxygen into the atmosphere than an equivalent stand of hardwood trees” (Maiti and Maiti 2017, 120).

The community is a multi-phase project that includes residential housing, a skill training centre, restaurants, commercial shops, recycling studios, material shops and a medical center when it has reached its maximum capacity. The community will not only serve as a communal gathering space, but also a social development project built for and by the local low-income group using bamboo material from the bamboo forest. Architects will provide design and technical assistance. Ideally, the community will develop and adapt to local needs, the programs and parts of the building will be built and rebuilt at different times over the life of the project.

Existing



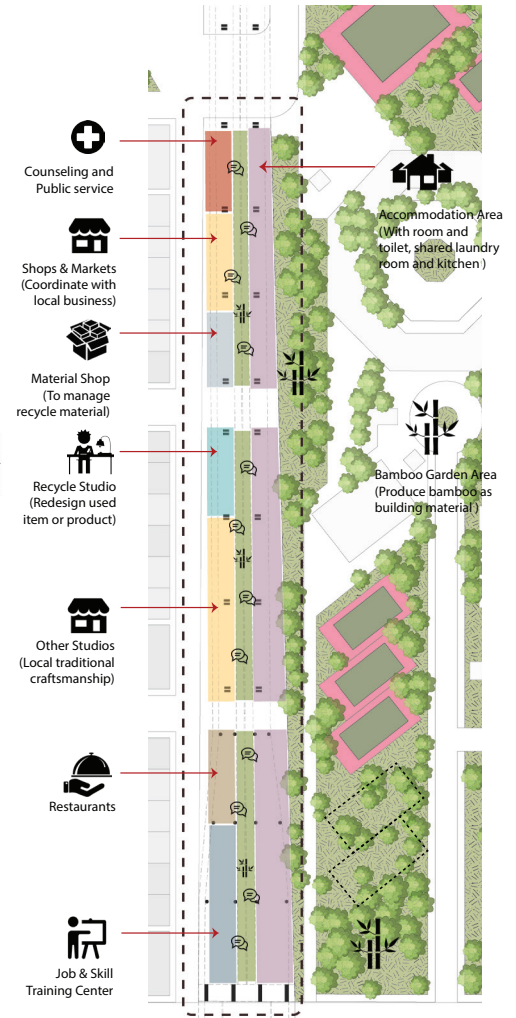
Circulation



Site strategy



Program strategy

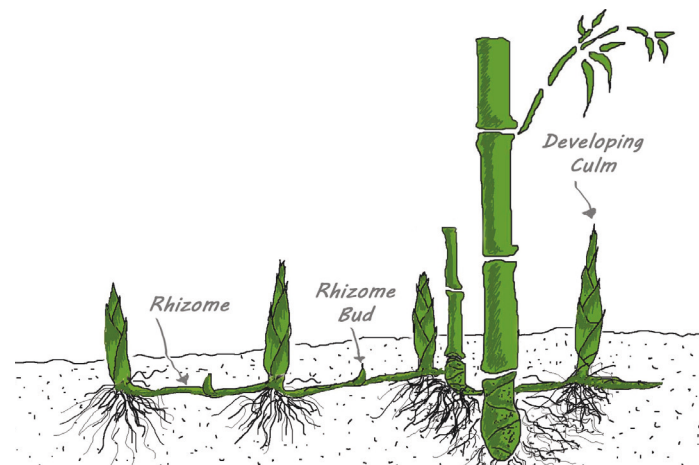


Site strategy diagram (base map from Good Earth 2019)

Chapter 7: Design Research: Bamboo Material

Bamboo Cultivation, Harvesting and Production

Once the homeless people evaluate as safe, the bamboo cultivation will start. There are two types of bamboo used in Hong Kong scaffolding: they are called Bambusa and Phyllostachys edulis. Compare with Bambusa, Phyllostachys edulis has a faster growth rate, and it is highly productive. It is a running type of bamboo and can grow over 17cm in diameter within three years; it has become the most commonly used specie for scaffolding during construction.



Running type bamboo

Grow Conditions

Phyllostachys edulis is not picky about soil conditions, but optimal soil conditions are a PH=7 or in a fertile, humus-rich, moist and well-drained soil with a high organic content. The tree specie that is currently growing on site is called Bauhinia, which shares similar soil condition criteria with Phyllostachys edulis. The ideal growth occurs in a warm climate with a hot summer and then cools to a moderately

cold winter. The plant will tolerate some frost, but it will seriously damage if temperatures go below 14 degrees. In Hong Kong the annual average temperature is above 25 degrees Celsius, which is the best climate to grow *Phyllostachys edulis*. Furthermore, most bamboo requires at least 4 hours of sunlight. Ideally the more sunlight, the more energy available to photosynthesis and growth. The bamboo forest is located next to the freeway and it is fully exposed to sun light most times of the day. Since there are no high buildings next to the forest to cast any shadows it is the best location to plant bamboo (Hidalgo-López 2003, 26).

Bamboo Cultivation

This type of bamboo can run underground and pop up to cover an increasingly larger area. However it can be easily contained with a root barrier, raised beds or rhizome pruning by local residents. When it comes to planting, a 75 cm deep plastic root barrier is required for running bamboo. During a very young age, a wind barrier is needed to prevent the bamboo from heavy wind damage. New bamboo should be treated as any other new plant until established. Once it is established, it will be strong enough to withstand hurricane force winds and extremely water-wise to become almost totally self-sufficient.

Bamboo can create a lot of biomass, mostly in the form of foliage. Bamboo leaves usually fall when they are between 12 to 18 months old, and they are quickly replaced with new leaves. As time goes by, the leafy mulch will accumulate and conserve moisture in addition to preventing soil erosion. "The mulch facilitates the intake and retention of moisture. The thick leafy blanket also assists the earth to absorb and retain moisture more effectively, and to reduce the rate

of evaporation. Leaves, being organic matter, also help increase the organic content of the soil. Bamboo litter (mostly leaves) have a high water retention capacity. The moisture that bamboo litter can hold weighs 2.75 times as much as its dry weight it self" (Zhou 2005, 145). So regular cleaning is required for bamboo litter to ensure an unobstructed public pathway. All the collected litter can be used as wrapping material, tea and compost for the community.

Bamboo has the ability to store carbon from the atmosphere as it grows. Generally speaking, how fast a plant grows has a part in determining how much CO₂ it can absorb in a given time. For the *Phyllostachys edulis* one hectare of this species can store up to 250 tons of carbon. Based on the CO₂ emissions from the World Bank, this translates into the amount of carbon that was produced in 2009 by around 160 people in China (Maiti and Maiti 2017, 122).

Bamboo Harvesting

After 2 to 3 years of growth, the bamboo can be harvested. During this period, the bamboo plant is acquiring and conserving nutrients for shoot growth in the next rainy season, thus, starch content is at its highest level at the end of the dry season. Therefore, harvesting bamboo at end of the dry season will increase the chances of borer and fungi attacks. During the rainy season, starch content is low but moisture content in the bamboo culms is high, which increases the possibility of subsequent splitting and cracking after harvest. This is also the period when new shoots emerge, and felling operations could damage or destroy the shoots. In other words the best time to harvest bamboo is at the end of the rainy season and beginning of the dry season, which is autumn (between October to

November) in Hong Kong. In terms of harvesting, all bamboo should be cut at the first or second node above the ground level. In this way, there is no receptacle in which rainwater can collect. Stagnant rainwater in the culm will cause rot and could weaken the bamboo plant system. Bamboo can be pruned to any height and it will not re-shoot from the cut, but rather in new leaves growing from the cut. These leaves will provide energy to the underground system and allow it to sprout new canes. Pruning an established bamboo should be done once a year, as the running type will normally give shoots from mid-to late-spring. This will give the bamboo enough time to build up energy and release new growth in the following season (Hidalgo-López 2003, 30).

The Post-Harvesting Transpiration method can also be used for bamboo harvesting. Once the bamboo is cut, it can lean against another bamboo and remain at the plantation for about four weeks, making sure the felled culm does not have direct contact with soil. In this way the starch content in the bamboo will be reduced. This method will improve the drying process of the bamboo culm and results in a beautiful uniform color of the dried culm (Hidalgo-López 2003, 32).

Bamboo Production and Supply

All harvested bamboo will be transferred to the bamboo factory for further treatment. To enhance its natural durability and to protect it from insects, it is necessary to treat bamboo before use. For treated bamboo, if it is placed under the roof or bridge and is not directly affected by sunshine and rain, the life expectancy of bamboo structures will last over 50 years.

During the bamboo treatment process, a long steel rod is used to drill through the center of the bamboo culm

throughout its whole length. This is to longitudinally penetrate the bamboo's nodal diaphragms before the natural preservation treatment. After that, the bamboo is soaked in a borax and boric acid solution pool for seven days, to allow the salts to penetrate the inside of bamboo fully. It is a natural insect repellent and preservative method. Then after about one week, the bamboo is pulled from the pool and tacked vertically so the preservation solution can drain from the bamboo and recycle in the pool. Next, the bamboo poles are left in the sun for about seven days. The sun will bleach the bamboo to a natural golden yellow color, which is attractive as a bamboo construction material. Finally, all the bamboo poles are left to dry slowly in a cool, dry place until they are used for bamboo construction (Hidalgo-López 2003, 40).

Bamboo Forest Management Strategy



Bamboo grow cycle

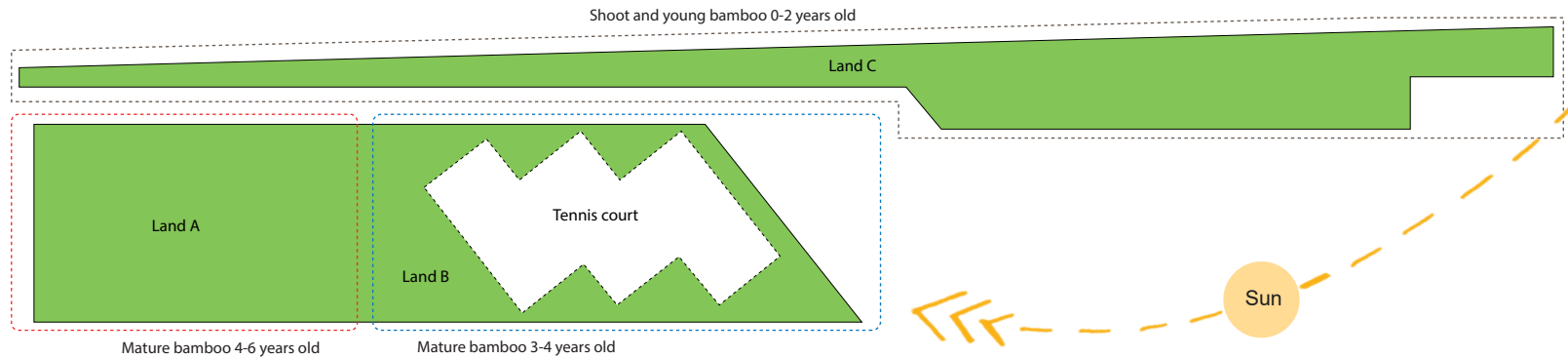
Based on the four stage of the bamboo growth cycle: shoots, young stems, mature stems and old stems, different sizes of bamboo can have different uses in the community. The bamboo shoots are mainly grown in planters by local residents and used as vegetables in the kitchen for Asian dishes and broths. Young bamboo after proper treatment will be used as material for furniture, building components and craft-works. The treated mature bamboo will be used as material for housing; the structural columns and beams (Nurdiah, 2016).

In order to generate different uses of bamboo materials, the strategy of continuous supply is proposed for 2.4 acres of existing land next to the freeway. The amount of land for bamboo cultivation and subdivision of land is based on the growing cycle of bamboo, and forecasting the growth of population to a maximum of 500 people; to fit to the maximum possible amount of housing and services under the bridge. The land can possibly be acquired by demonstrating or lobbying the associated non-government organization such as Impact HK (a registered NGO for homeless care).

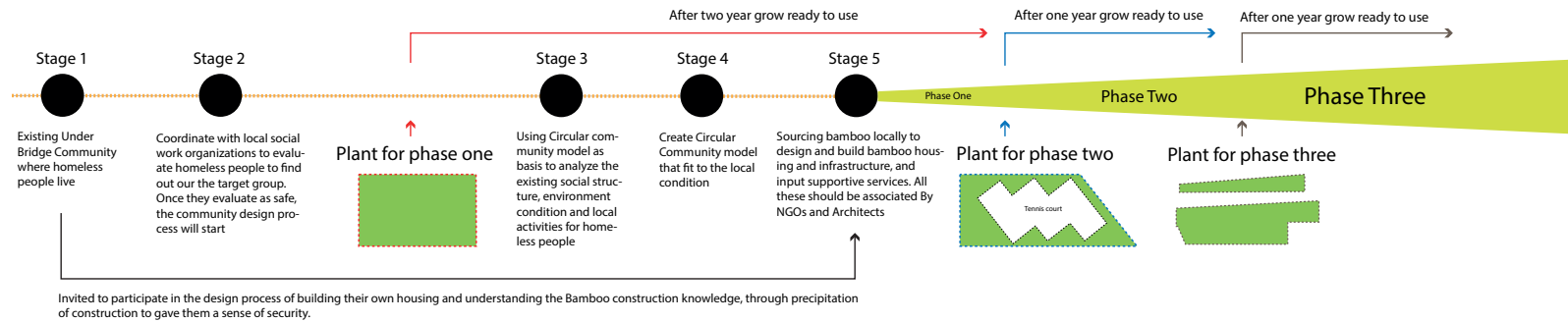
During the construction process in phase one, while land A is in use, the bamboo cultivation will start on land B for future phase two use (see diagram p.43). A similar strategy is also applied for land C and phase three in the future. With this bamboo cultivation strategy, by the end of phase three, the bamboo forest can keep producing the bamboo material of different ages for various building and social activities.

After phase three, when the community has reached its maximum capacity, the bamboo forest will need to be maintained and managed by local residents and NGO workers. This will ensure the proper age of bamboo and its production to meet the demand of the community and surrounding neighborhood for material use.

Strategy of Continuous Supply (2 Acre of Land)

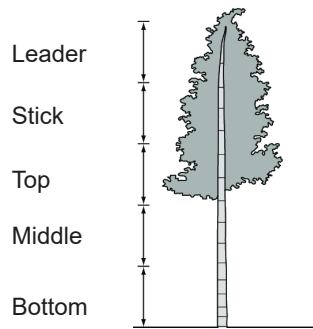


Community Forming Time-Line



Phase One

Phyllostachys Edulis Characteristics



Bamboo illustration, Bogota, 2002 (Hidalgo-López 2003, 100)

Phyllostachys edulis is also called Moso bamboo, which is one of the most used species in China. The natural shape of a bamboo has three different parts of stem: The bottom, middle and top pieces. For construction purposes, the parts of stem need to be carefully selected. Because a bamboo stem does not have a continuous cross section like a standard tree and there are differences in structural properties between the lower and upper parts. The lower part, which has a larger diameter, and the upper part, which has a smaller diameter. For construction purposes, the bottom, middle and top portion of stem can be used as beams and columns. The stick and leader part of the bamboo culm should not be used in the construction, because they have small diameter.

Compressive Strength of Moso Bamboo

The compressive strength of 3 - 4 years old bamboo is roughly situated between 40 and 80 N/mm² (green state). The compressive strength from 5 years old Moso decreased by 16% compared to the 3 - 4 years old Moso. Even so, the compressive strength is still twice to four times the value of most timber species. However the moisture and age content of bamboo have a significant influence on the compressive strength. In general, bamboo with lower moisture content has a higher compressive strength than bamboo with higher moisture content (Stéphane 2020).

Tensile Strength

The bamboo fibers determine the maximum tensile strength of bamboo. The average tensile strength of bamboo is situated roughly around 160 N/mm², which is often three

times higher than most standard construction grade timbers (Stéphane 2020).

Shear Strength of Moso Bamboo

The maximum shear strength for bamboo is an essential factor in designing an appropriate joinery system and connection. Moso bamboo offers the most resistance to shear in the middle and upper part of a three to four years old stem, and the average shear strength of Moso bamboo is 9 N/mm² at a moisture content of approximately 56.6%. In general shear strength is nearly ten times lower than compressive strength and even 20 times lower than the tensile strength of the same bamboo. But even so, the shear strength of bamboo is often twice the value of popular timber species in North America (Stéphane 2020).

Bending Strength of Moso Bamboo

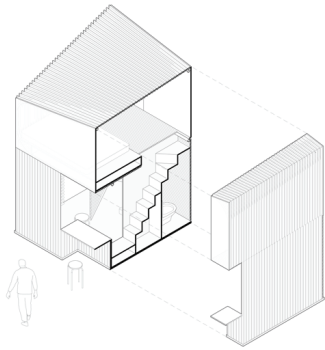
Bending strength has a direct influence on the behavior of a structure. For the top part of the stem, the highest modulus of elasticity is measured when they are three to four years old. The modulus of rupture is the highest in the top part of the stem. Overall the bending strength of Moso bamboo is between 50 to 80 N/mm² and is twice as strong as most conventional structural timbers. Variations are normally caused by different test method sample quality and moisture content of the tested bamboo (Stéphane 2020).

Bamboo Micro Home

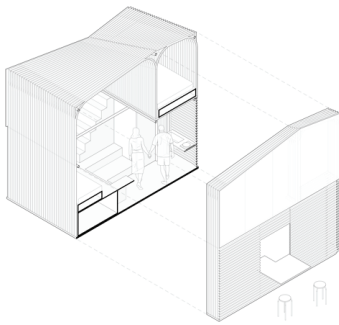
The structure is designed by Dylan Baker-Rice. It is a 1:1 prototype, both inexpensive and relatively easy to construct by using bamboo, which is cheap and plentiful in Hong Kong.

Bamboo was chosen as one of the most sustainable and abundant natural materials in Southeast Asia. It is one of the fastest growing plants on the planet, and is three times faster than wood. Some species can grow 32 inches within a 24 hour period and its strength to weight ratio exceeds steel. It is commonly used to create structures in Hong Kong. By using bamboo as a low-cost and sustainable material, the house can be constructed quickly and safely.

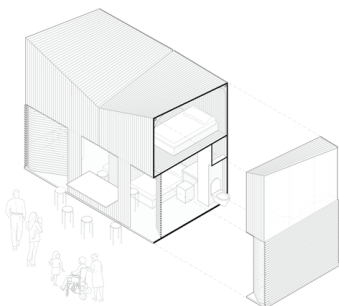
This Micro-Dwelling idea not only can help people to build their custom houses based on different sizes of family, but can also be a temporary solution to solve not having enough public housing for a limited period of time.



Dylan Baker-Rice, dwelling for single occupant, Hong Kong, 2014-6 (Frearson 2014)



Dylan Baker-Rice, dwelling for couple, Hong Kong, 2014-6 (Frearson 2014)



Dylan Baker-Rice, dwelling for family, Hong Kong, 2014-6 (Frearson 2014)

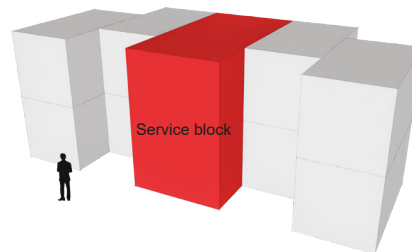


Dylan Baker-Rice, bamboo micro home, Hong Kong, 2014-6 (Frearson 2014)

Chapter 8: Architectural Design

Architectural Proposal for the Community

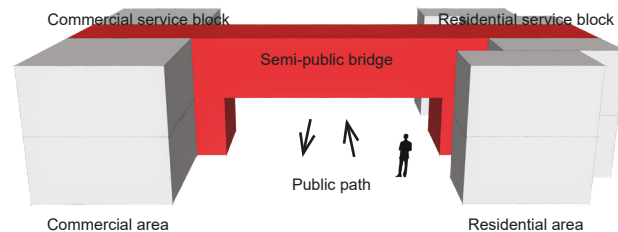
The project proposes a modular system of dwelling units to help the community itself become more sustainable. The dwellings can easily adapt to the changing needs of their inhabitants and either grow or reduce according to the size of the family at a certain point in time. The dwelling unit is made of bamboo and recycled materials with mechanical fixings which can be easily obtained from a local source in SSP. All the material can be reused or recycled through the local waste factory as a material again.



Typical residential living module

The typical bamboo housing group consists of eight living cubes, which can hold a maximum of thirty-two persons. The bamboo structures are attached to a bamboo-reinforced cavity brick wall which in turn provides ventilation and electrical services. There is a service block in the middle primarily built with bricks to provide one shared kitchen with two stoves and two washrooms. The service block is connected to the commercial area through the semi-public bridges to allow the inhabitants to further engage with the public (see diagram p.48).

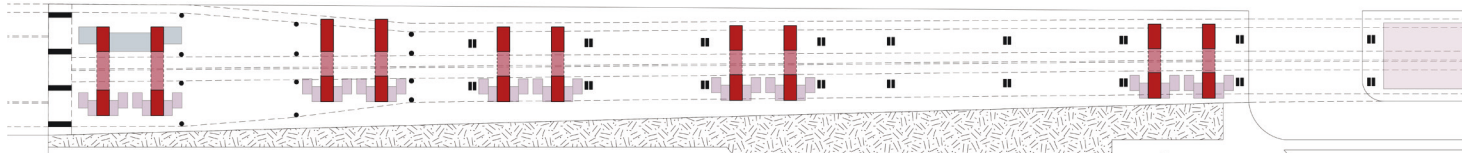
The service block is a relatively permanent heavy solid structure (that can support and brace the lighter bamboo structure). During the construction process, the service block always comes first, then the number of living cubes will be adapted based on the changing needs of inhabitants in different phases of housing demand. Furthermore, the service block not only can provide basic daily needs for the community, but also can generate bio-organic fertilizer and irrigation water from daily waste. This fertilizes in a sustainable way the bamboo forest, so that the community and forest become mutually beneficial. Even if in the future, when the homeless problem is usefully addressed, and the light bamboo structures are dismantled or re-formed, the service blocks can still function in their own way; as public facilities and as a part of the garden ecosystem.



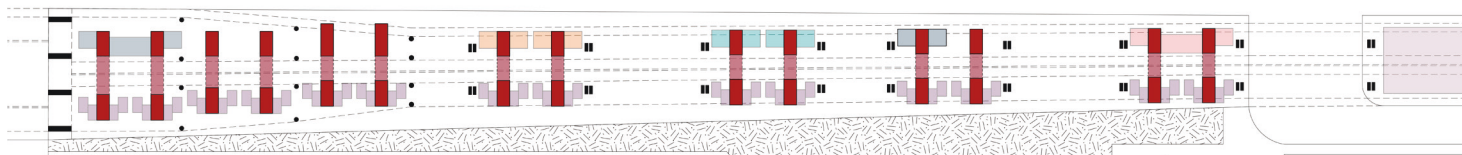
Typical residential and commercial living module

The housing has everything planned that people would not have an easy time building alone without professional building knowledge, such as plumbing, foundation, electricity, roof and a basic structural frame. People are invited to participate in the design process of building their own housing, and architects will provide the design and technical assistance. With this idea we can not only encourage homeless people to develop new skills, but also through the participation in construction to offer them a sense of grounded security.

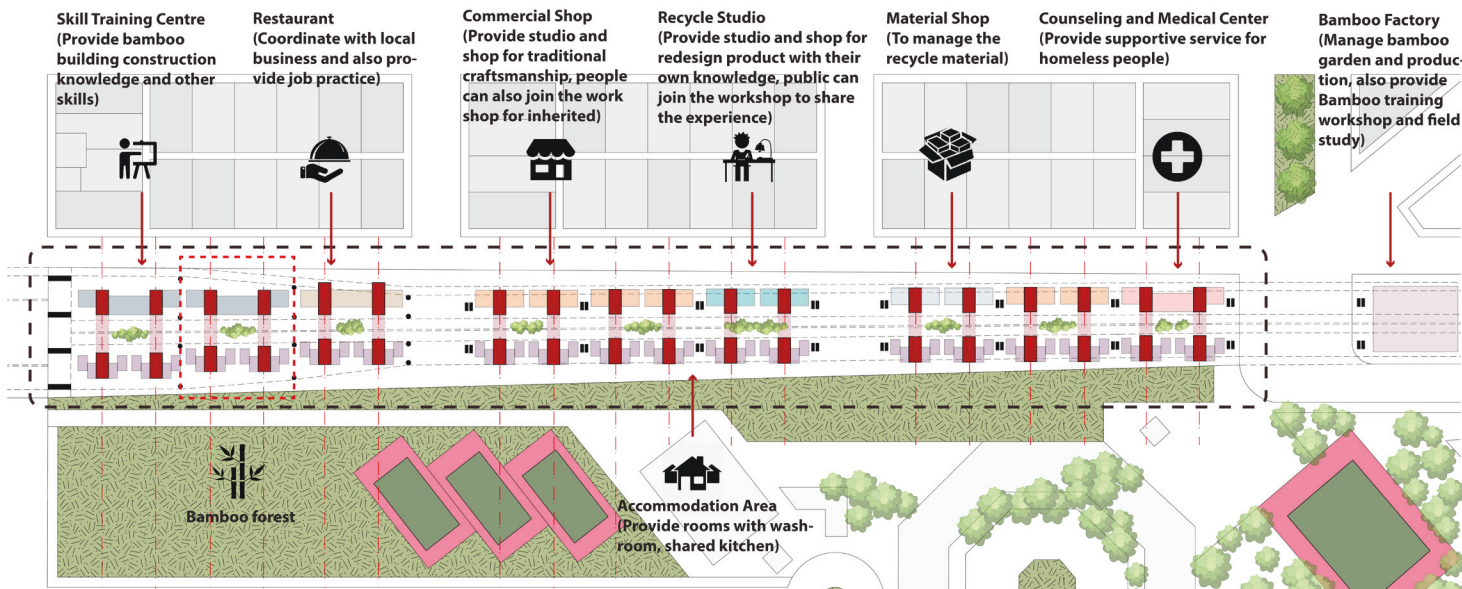
Phase One



Phase Two



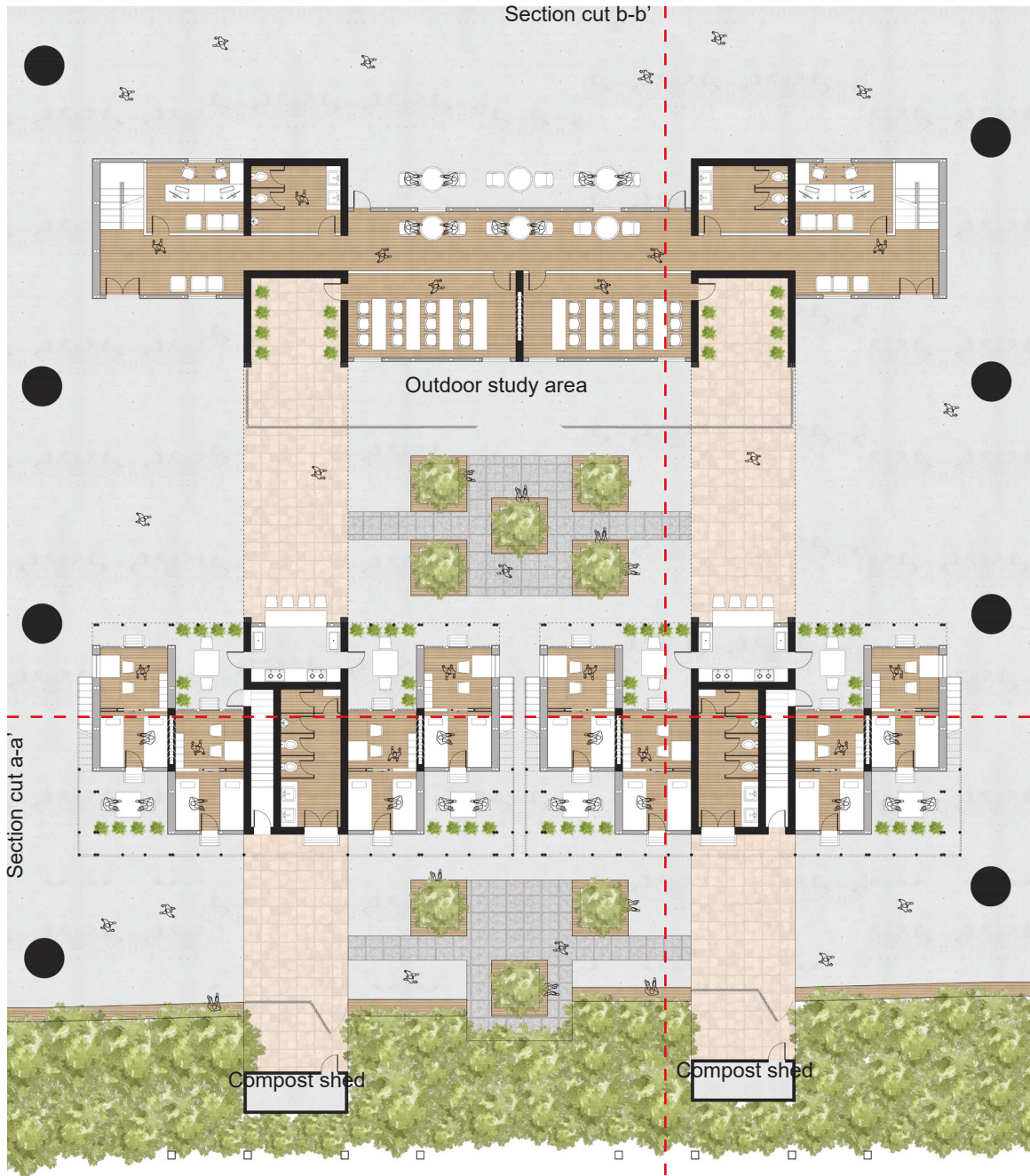
Phase Three



Site plan in different phase (base map from Good Earth 2019)



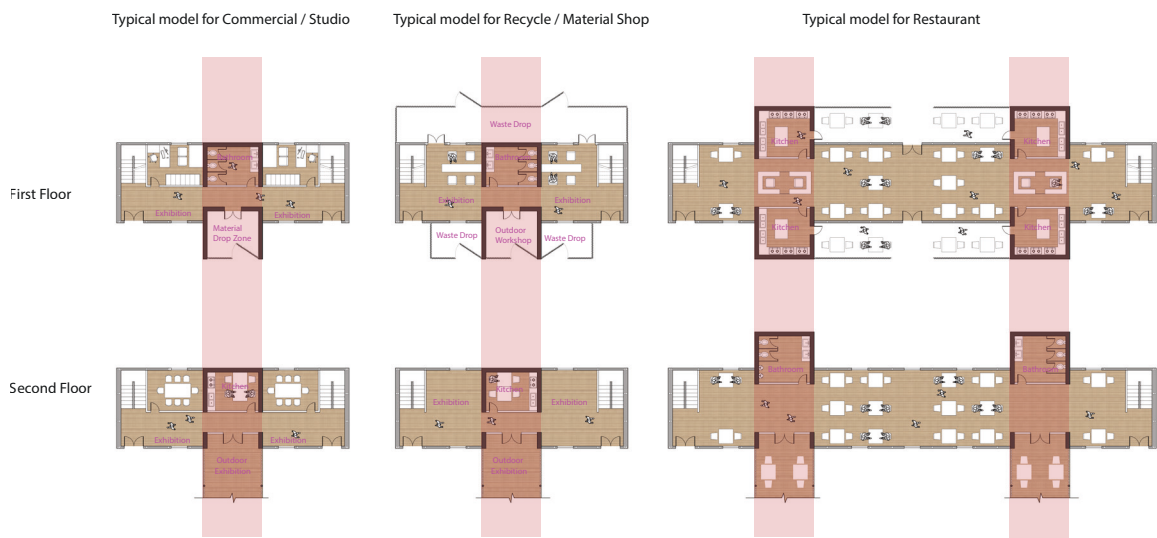
Phase three when reach to the maximum capacity



First floor plan (skill training center and residential housing)



Second floor plan (skill training center and residential housing)



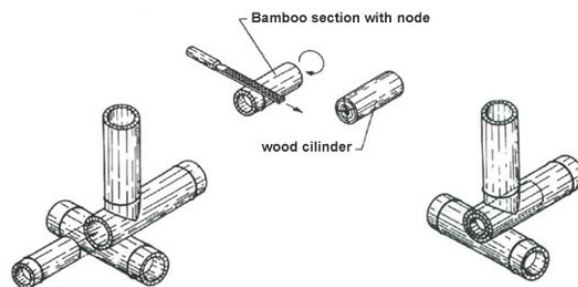
Variations for other commercial use

Adapting Traditional Bamboo Construction Methods



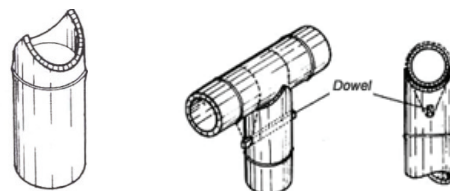
Bamboo illustration, Bogota, 2002 (Hidalgo-López 2003, 225)

The use of bamboo nodes as joint connection is very important in the construction. Bamboo beams and columns need to have a node at both ends, otherwise, the load of a structure on the joint will crush the bamboo.



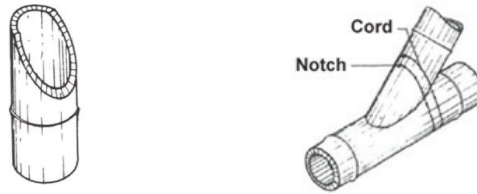
Bamboo illustration, Bogota, 2002 (Hidalgo-López 2003, 225)

If both end nodes bamboo are not available, the wooden cylinder of the appropriate diameter or a piece of bamboo with a node is required.



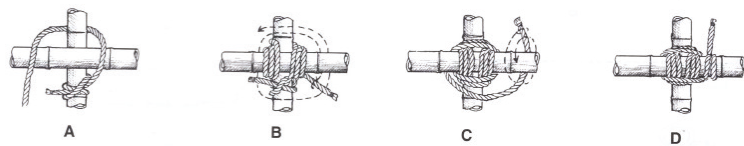
Bamboo illustration, Bogota, 2002 (Hidalgo-López 2003, 229)

Fish mount joint with dowel and lashing technique is used for the basic structural frame work.



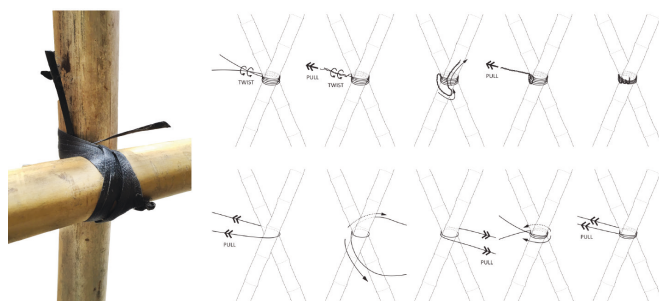
Bamboo illustration, Bogota, 2002 (Hidalgo-López 2003, 227)

Scart joint with wire tie is often use as diagonal brace to stabilize the structure from the lateral force.



Bamboo illustration, Bogota, 2002 (Hidalgo-López 2003, 287)

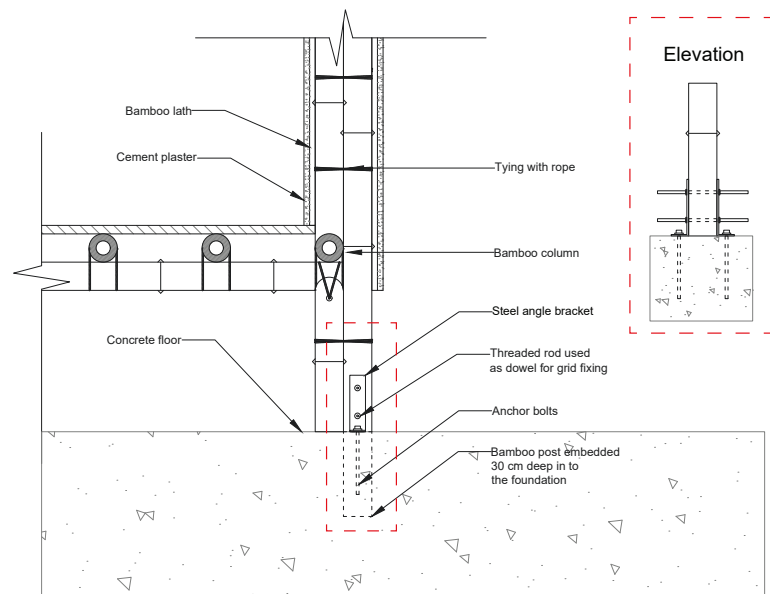
Square lashing technique is the most common way of tying two bamboo culms together and is used for floor and roof joint connections.



Scaffolding lashing technique by using back nylon wires

In Hong Kong, the use of bamboo scaffoldings and sheds can be traced back as far as the Han Dynasty (206BC-

220AD), and the technique has been passed on from generation to generation. Nowadays the bamboo skin ties are being replaced by black nylon wires, but the craft has not substantially changed. The simplicity of this bamboo construction technique can be quickly learned by any non-educated person, particular the homeless group. There is an existing scaffolding training zone next to the site under the bridge, which can be used as bamboo storage and skill training ground for local community.



Foundation detail

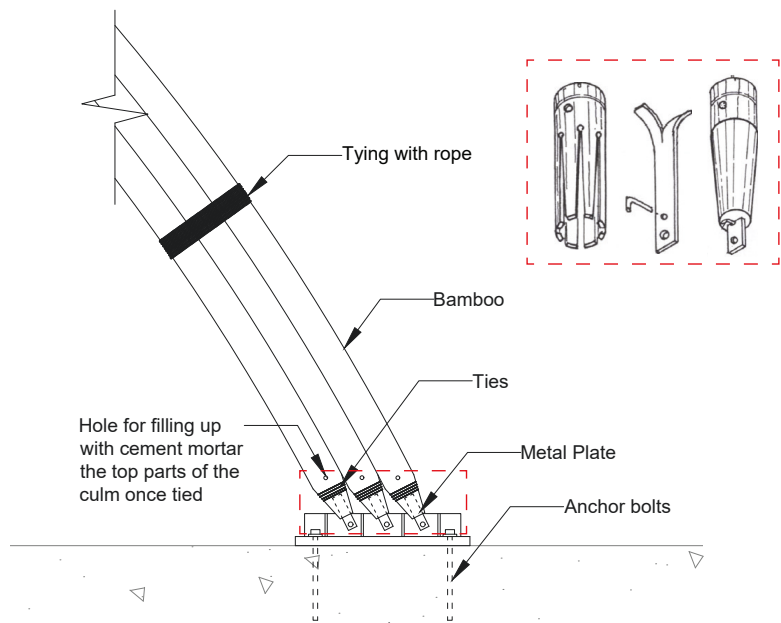
For the foundation, the bamboo canes should never touch the soil, since they should not be exposed to the moisture. a minimum diameter of 70mm bamboo post is required.

The traditional way of installing a bamboo post into the foundation is to make a 300 deep and 100mm diameter hole on the concrete ground. Before inserting post, bamboo must undergo a Tar or creosote treatment at the bottom. Then the spaces between culm in the hole should be filled

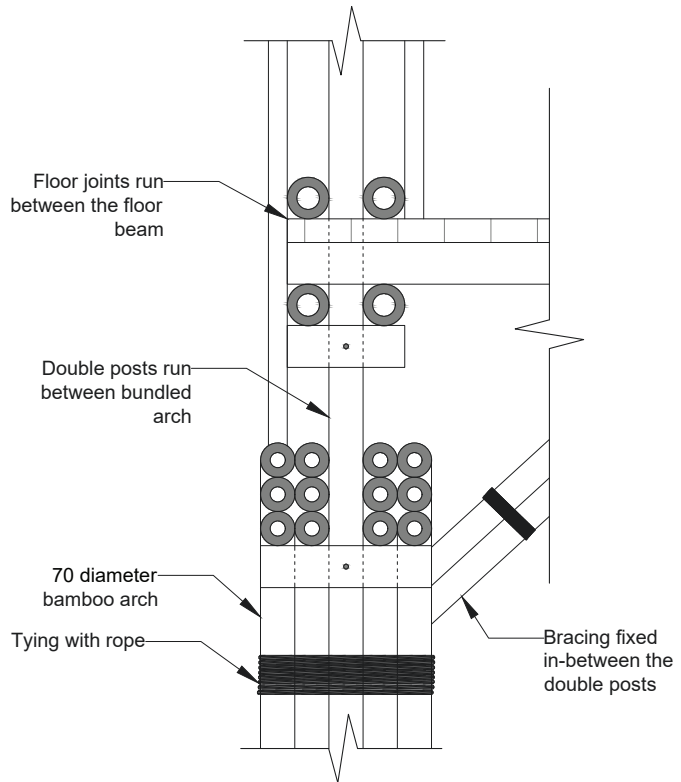
with sand or cement mortar to stabilize the post. Another possibility allows fixing a bamboo post and foundation with bolts and steel brackets and anchor bolts. At this point bolts should be embedded in the concrete floor at the appropriate place (Hidalgo-López 2003, 300).

For the arch structure, the Post - Harvesting Transpiration method can be used for an arch purpose structure, because green bamboo with higher water content is more useful for bending, usually a short window of time after harvesting. The hot bending method is generally used in China, it can be done by immersing green bamboo in the warm water until the fibers become soft enough to curve using a clamp or by heating the bamboo section to the desired heat of 150° that causes bamboo fibers to become soft and easy to bend. A diameter of no more than 70mm bamboo can be selected for bending, because bamboo with a smaller diameter makes an easier technique for bending.

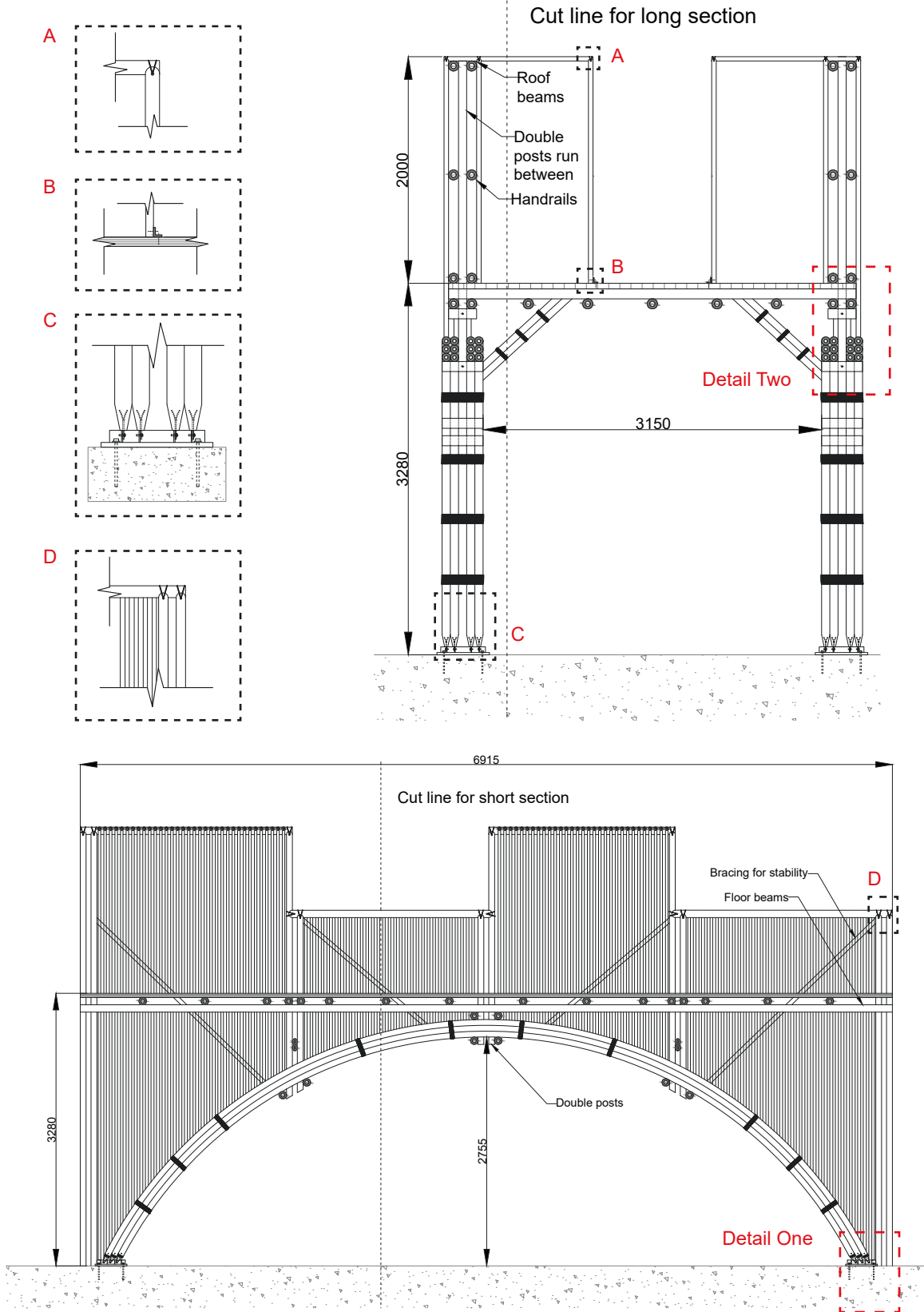
The metal cone technique is required for the semi-public arch bridge at the ground connection. This is a type of strong joint in which a sheet metal and internodes with cement mortar are used. A metal cone replaces the cords and gives a better aspect to the tip of the strut. Multiple bent bamboo arches can be joined together and tied with rope to increase the overall arch strength (Hidalgo-López 2003, 320).



Bundled arch construction detail one



Bundled arch construction detail two

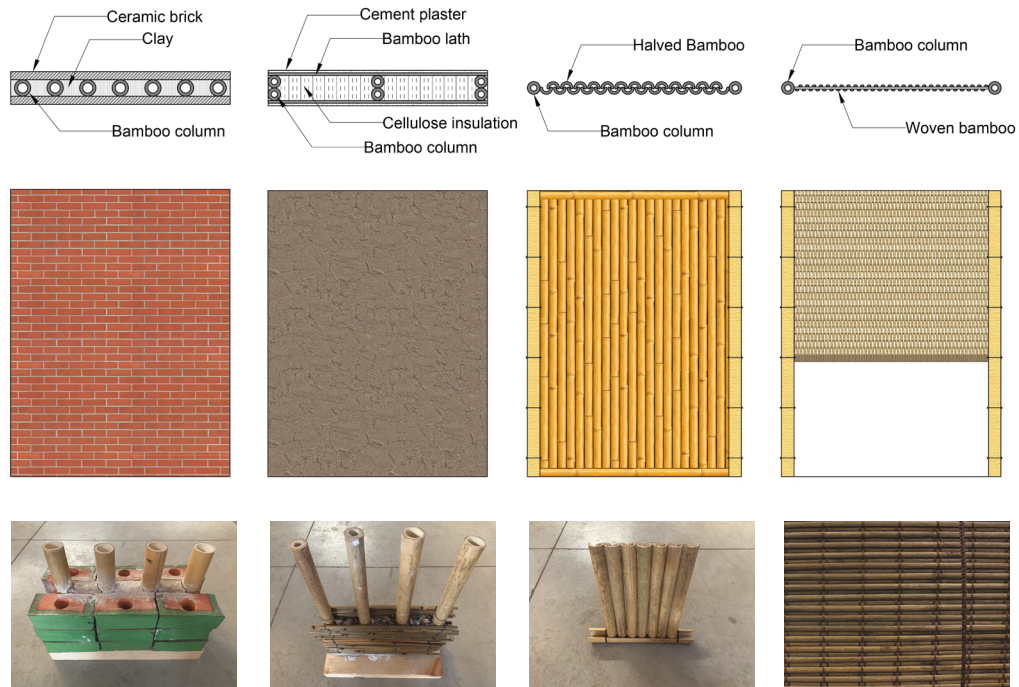


Arch bridge sections

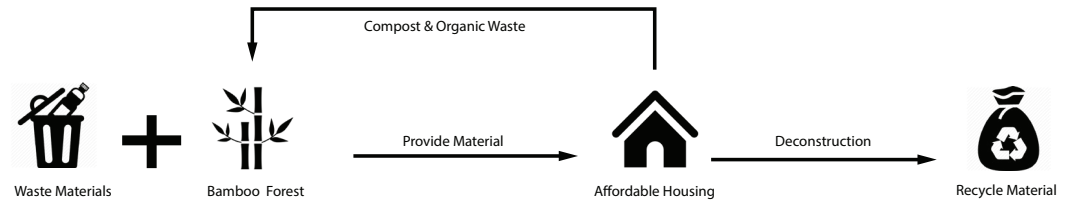
Primitive Material, Simple Construction System

There are four type of walls used for housing, and each wall is a bamboo-based structure and functions differently.

Wall type one shows bamboo as reinforcement for a brick wall and partially infilled with clay. The wall is used for kitchen and bathroom construction as an air chimney. Wall type two is consists of horizontal bamboo strips tied or nailed to both side of the posts. The cavity is then filled with cellulose insulation, which is made from waste newspaper. This is used for the bedroom wall as a sound barrier. Wall type three demonstrates a spilled or flattened bamboo and can be fixed vertically and inter-jointed. The structure is tied to the bamboo posts on both sides. The wall can be used for an outdoor fence or living room partition. Wall type four is more like a bamboo woven curtain made by local craftsmen and can be used as a door where less privacy is required.



Bamboo wall types (type 1, type2, type3, type4)



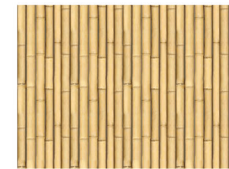
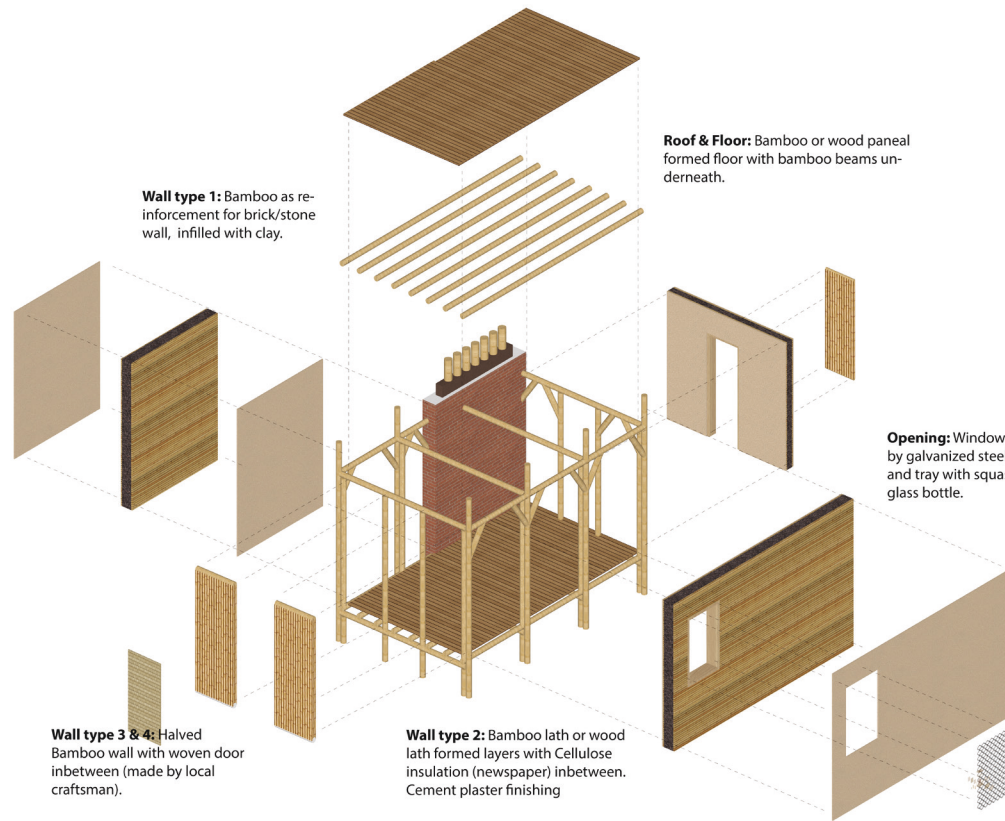
Local stone and brick



Cellulose insulation from old newspapers



Any wood panels from construction waste



Bamboo from bamboo forest



Metal cage from old cage house



Glass bottle from local waste

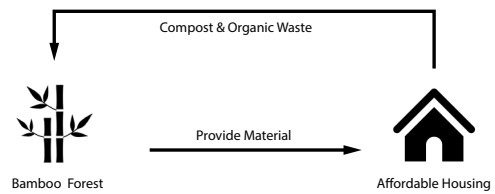


Clay from local forest

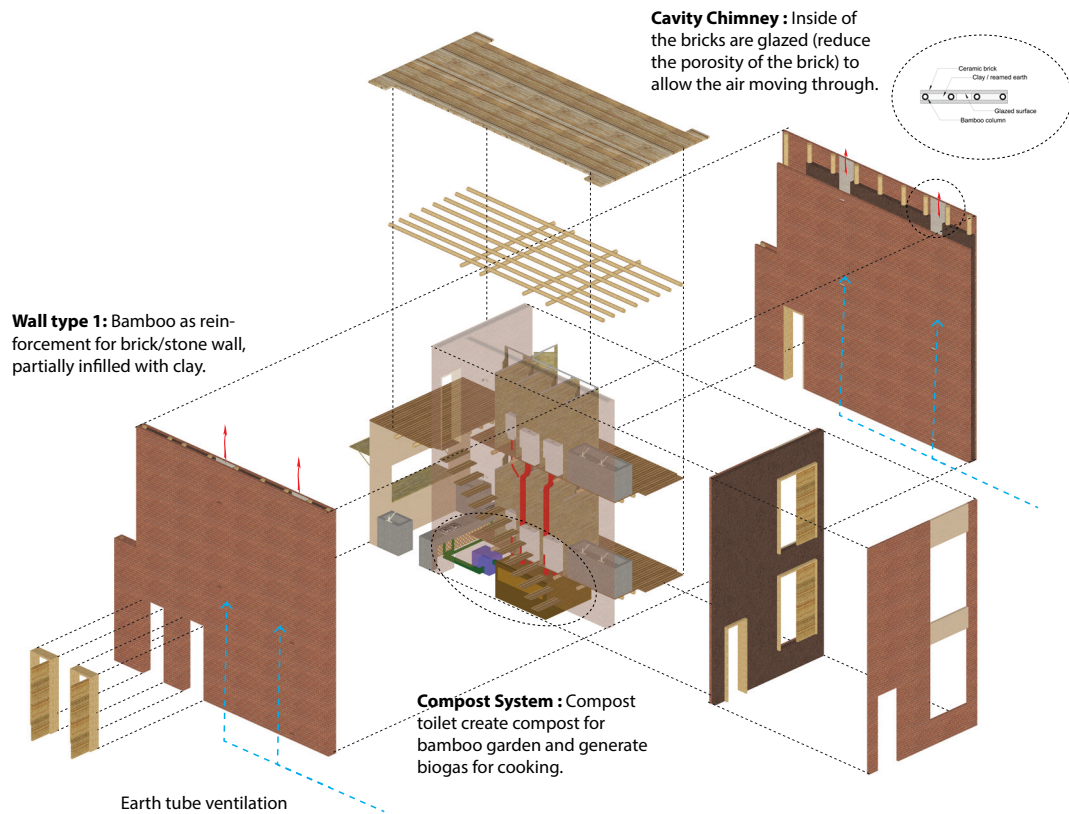
Material, structure and construction (typical cube)

An Ecologically Integrated System

The service block is functioning like a car engine for the community and bamboo forest. The human waste gets composted under the floor, and once ready, it will be transferred to the compost shed and used for the bamboo forest. The biogas system is connected to a compost chamber, which can turn by-products of human waste into cooking gas and serve the residents.

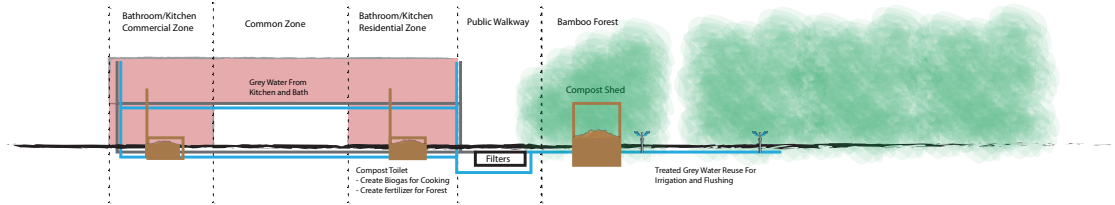


Idea of circular economy

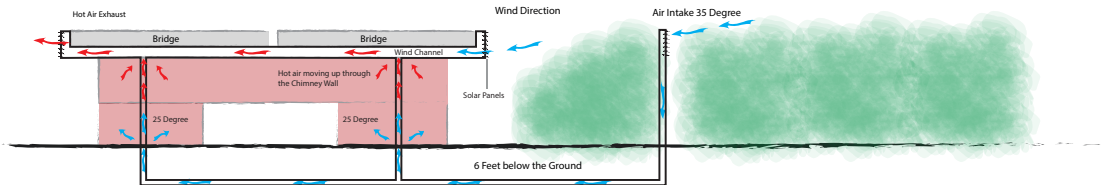


Ecological integrate system (service block)

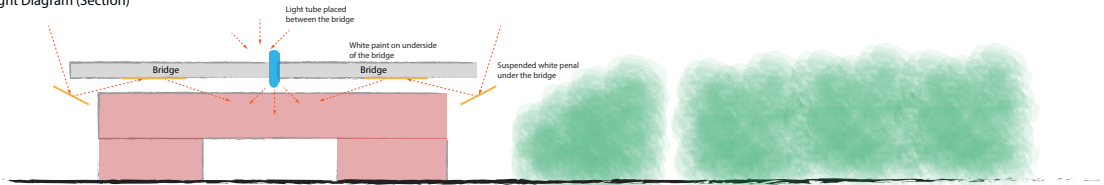
Service Block Diagram (Section)



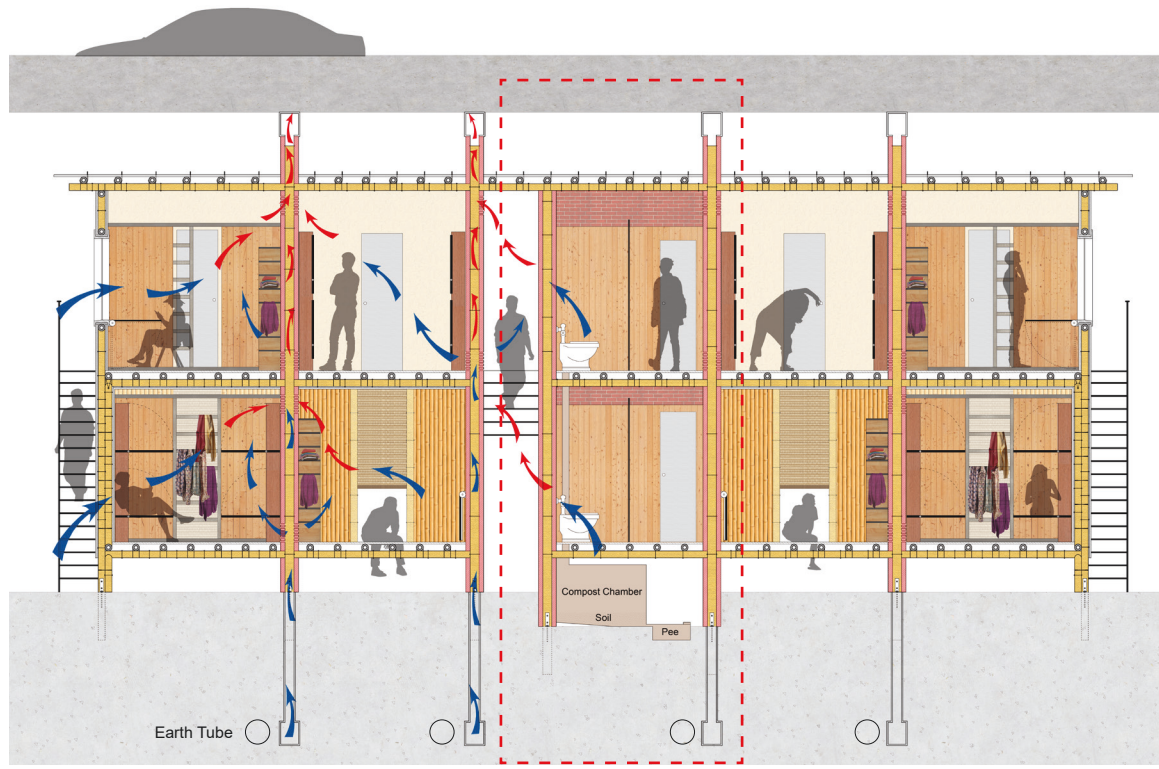
Ventilation Diagram (Section)



Light Diagram (Section)



Integrate diagrams



Integrated section a-a'



Section cut b-b'

Community Visions and Vignettes



Community entrance



Public walkway next to the bamboo forest



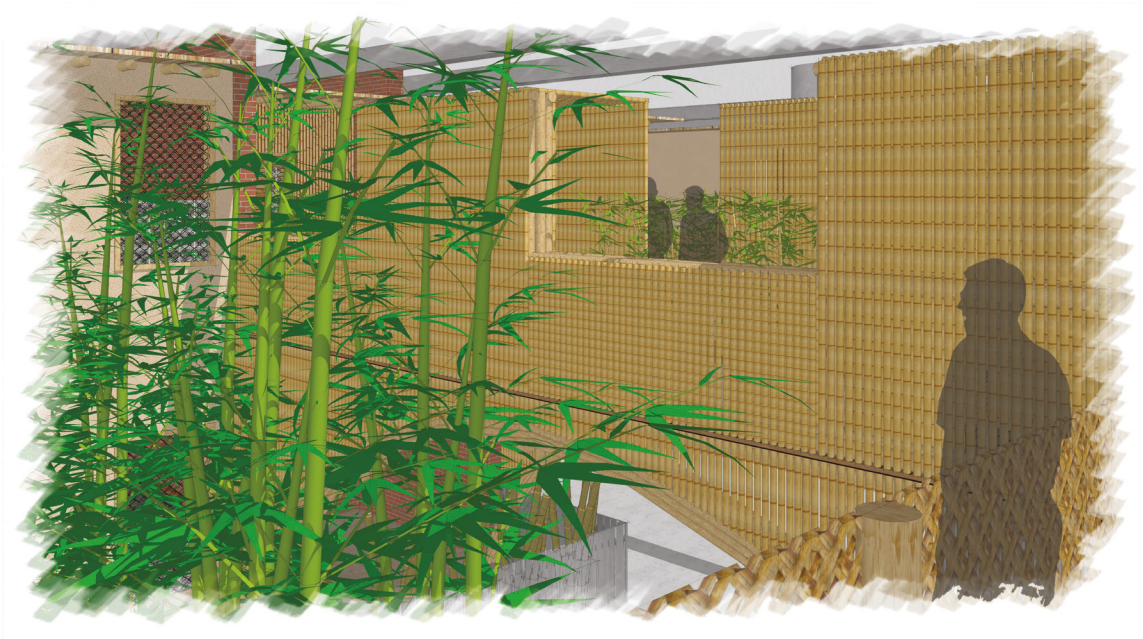
Create a cave experience public walkway in between the commercial and residential areas



Semi public space on the bridge to engage with the public



Kitchen counter and eating space invite public to join



View from residential balcony

Chapter 9: Conclusion

This thesis has investigated housing the homeless population in Hong Kong by using bamboo material. With the introduction of a bamboo forest as a material source, it in turn usefully provides accommodation and infrastructure for the existing under-bridge homeless community.

The inspiration for this thesis project is the social circular economic theory, and the designed community successfully reflects the sustainability of the environment, society and economy as considered in a continuous loop, with positive reinforcement from one to the other. Furthermore, the community model has considered the challenge of homeless insecurity and their living situations by given opportunities for them to design-build their own house and create a friendly environment for living within their own abilities.

From an ecological sustainable viewpoint, the bamboo forest is introduced next to the freeway as a form of environmental buffer. Bamboo as a material source can in turn provide low carbon building material for housing and workshops. Furthermore, with the integrated design of the service block, the community is able to generate bio-organic fertilizer and irrigation water from daily waste for the bamboo forest, so that the community and forest become a mutually beneficial system. Further research into composting specifically for a bamboo forest would be of interest.

From a social sustainable aspect, The idea of rethinking homeless people as a human resource in society is very important, with a focus on reuse renewal and social anchoring. The community not only serves as a communal gathering space, but also as a social development project

that is built for and by the local low-income group with professional assistance. This new community economic model calibrates the introduction of Bamboo enterprise with the host community and existing skillsets. It can then serve local people and help generate an integrated, diversified community.

As architect, we aim to design beautiful buildings; but equally critical is how to engage with design to achieve sustainable architecture. During the research process, I found that only building itself cannot solve the homeless problem; it is necessary to consider sustainability from three different aspects simultaneously: the environment, society, and the economy. Through this idea, architectural design not only focuses on a physical object; it is more like a spider-net which links relevant context strongly, (like programme, social activity and the public realm). All of those factors together make the design truly unique. Then the design will benefit our humanity and I deeply believe this is how architecture contributes to our evolution.

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