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ARCHITECTURE AND URBAN DESIGN

Rewriting the Palimpsest of Fenghuang Town between the Old and New

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Abstract

The theme of the thesis focuses on how to coordinate the architectural heritage with contemporary architecture in the Chinese historical conservation town, the Fenghuang Town, by introduce the Italian "Riscrittura" architectural thinking. The concept of Rewriting (Riscrittura) is learned from the author's supervisor, Professor Laura Pezzetti. According to the basic concept of rewriting, the author analyzed its origin and some relevant concept, and giving the new interpretation of the concept of Rewriting, by analyzing some Italian architects.

The general features of the Fenghuang Town was given in the Chapter II. Inspired by the prof. Laura, the author analyzed the ancient Fengshui theory of this town, and understood the urban structure of the Town, which is the radial strip structure. The interest of the author focused on the area of the Old Street and the New Street of the Town, and the situation of the chaos of the area would been dissected.

The general urban strategy between the Old and the New included 2 parts. One is the Latitude aspect, the strategy of continuity, and the other is the Longitude aspect, the strategy of Rewriting the Cultural Axis, according to its urban structure.

The last part of the thesis is the strategy of the architectural design. 4 parts are included in the project area, the Erlang Temple, the Lacuna, the Fragment and the Modern Generic Buildings. The design would follow the trace of the history of this area, and of course, would use the modern material and technology for improving the quality and performance, and guaranteeing the identification of the new design. For improving the energy performance in the project, setting the Net Zero Energy Building as the goal, the project is adopted the PV system and Ground Source Heat Pump. Through calculating the PV energy delivered and electricity consumption the author is dedicated to make a balance.

Keywords: Rewriting; Palimpsest; Stratification; the Fenghuang Town

Astratto

Il tema della tesi si concentra su come coordinare il patrimonio architettonico con l'architettura contemporanea nella città di conservazione storica cinese, la città di Fenghuang, introducendo il pensiero architettonico italiano "Riscrittura". Il concetto di Riscrittura (Riscrittura) viene appreso dal supervisore dell'autore, la professoressa Laura Pezzetti. Secondo il concetto base di riscrittura, l'autore ha analizzato la sua origine e alcuni concetti rilevanti e ha dato la nuova interpretazione del concetto di riscrittura, analizzando alcuni architetti italiani.

Le caratteristiche generali della città di Fenghuang sono state riportate nel capitolo II. Ispirato dal prof. Laura, l'autore ha analizzato l'antica teoria del Fengshui di questa città e ha capito la struttura urbana della città, che è la struttura a strisce radiali. L'interesse dell'autore si concentrava sull'area della Old Street e della New Street of the Town, e la situazione del caos della zona sarebbe stata sezionata.

La strategia urbana generale tra il Vecchio e il Nuovo includeva 2 parti. Uno è l'aspetto Latitude, la strategia di continuità e l'altro è l'aspetto Longitude, la strategia di Riscrivere l'Asse Culturale, secondo la sua struttura urbana.

L'ultima parte della tesi è la strategia del progetto architettonico. 4 parti sono incluse nell'area del progetto, il Tempio di Erlang, la Lacuna, il frammento e i moderni edifici generici. Il design seguirà la traccia della storia di quest'area e, naturalmente, userebbe il materiale e la tecnologia moderni per migliorare la qualità e le prestazioni e garantire l'identificazione del nuovo design. Per migliorare le prestazioni energetiche del progetto, impostando l'obiettivo di costruire un edificio a energia zero, il progetto adotta il sistema fotovoltaico e la pompa di calore geotermica. Attraverso il calcolo dell'energia fotovoltaica erogata e il consumo di elettricità l'autore si dedica a fare un bilancio.

Parole chiave: Riscrittura; Palinsesto; stratificazione; la città di Fenghuang

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Chapter I Concept of Rewriting Thought

1.1 Interdisciplinary Concept Citation

1.1.1 Palimpsest

The concept "Rewriting" (Riscrittura) is derived from the "Palimpsest" of ancient Western civilization. In ancient Greece and Rome, there was no paper. People could only use a certain quality material such as parchment for recording. Because these materials are so scarce and expensive, people often scrape the surface after use and re-smooth it for recycling using. Therefore, there are multiple layers of information on the surface of these parchments which are called "Palimpsest". Palimpsest shows the collective memory of people in the form of architecture. It can reflect the architectural phenomenon of the past and connect people with historical culture and events. As an important architectural tool, the architect's perception of the value of the Palimpsest can allow the experiencer to feel the relationship between the past, present and future through architecture: "*重写本以考古学的方式提醒我们过去建造的真实情形。*" (I*n an archeological way, the Palimpsest reminds us the real situation of the past construction.*)[1] The earliest introduction of the concept of Palimpsest in Italian modern period was "Il territorio come palinsesto" published by André Corboz in "*Casabella*" in 1985 (The territory as a Palimpsest), and he analogizes territory to "Palimpsest":[1]

"*The territory, overloaded as it is with traces and past readings, looks rather like a palimpsest. To install new structures, to make more rational use of certain lands, it is often essential to change their substance irreversibly. But the territory is not a disposable container either. a consumer product that can be replaced. Each territory is*

[1] Author learned the idea of "Palimpsest" from Prof. Laura Pezzetti, and read the references of prof. to learn what is the "Rewriting", including understanding the Italian reference "Il territorio come palinsesto".

unique, so it is necessary to "recycle", scratch once more (but possibly with the utmost care) the old text that men have inscribed on the irreplaceable soil material, to lay down a new one, which responds to the needs today, before being in turn repealed. Some regions, treated too brutally and improperly, also have holes, like a too scraped parchment: in the language of the territory, these holes are called deserts."[2][2]

The relationship between territory and city is inseparable, and scholars in the field of architecture have gradually accepted this concept. At the same time, they realized the concept of "Stratification" from "Palimpsest". The process of combining "new" and "old" is a concept of "layer" from a historical perspective, and "rewriting" is the carrier of these "layers". The significance of the existence of urban rewriting is based on the time stratification based on architectural forms, even those that have remained in history.

1.1.2 Stratification

The concept of "Stratification" in Italian is "Stratificazione" which is a geological concept. Carlo Scarpa was the first architect to put it into architectural practice. In Richard Murphy's lecture at the University of Sheffield, who is a famous architectural critic in the study of Scarpa, mentioned that Scarpa's attitude towards building renovation:

"I sometimes use and talk about his work formally used the idea of geology. You know we're conscious of geology being additive and subtractive and we're not that geology we think of as layers of sediments that gradually make their way up into rock, and then, we also think of the actions of waves and sand and wind that erode into rock, and we can see, we

[2] Il territorio, sovraccarico com'è di tracce e di letture passate, assomiglia piuttosto a un palinsesto. Per insediarvi nuove strutture, per sfruttare più razionalmente certe terre, è spesso indispensabile modificarne la sostanza in modo irreversibile. Ma il territorio non è un contenitore a perdere né. un prodotto di consumo che si possa sostituire. Ciascun tenitorio è unico, per cui è necessario "'riciclare", grattare una volta di più (ma possibilmente con la massima cura) il vecchio testo che gli uomini hanno inscritto sull'insostituibile materiale del suolo, per deporvene uno nuovo, che risponda alle esigenze d'oggi, prima di essere a sua volta abrogato. Alcune regioni, trattate troppo brutalmente e in modo improprio, presentano anche dei buchi, come una pergamena troppo raschiata: nel linguaggio de territorio, questi buchi si chiamano deserti.

can see the true nature of the building by the material, by how you erode into it, and I think Scarpa did both those things constantly."[3]

"Stratification" is closely related to human's memory. The word "memory" comes from the Greek word "Mnemosyne", who is the mother of the Muse. When humans are talking about memory, they do not refer to history, because they are two completely different concepts. Memory is expressed by analogy. It converts concepts into forms that are familiar to humans and stores them in the human brain, so that people rethink and interpret primitive objects. That is a bridge that connects the past and the future.[3]

A story about the frescoes of the Castle of Valentino in Italy can perfectly explain the concept of "Stratification". In the direction of the upper right corner of the dome of the castle hall, you can see a little angel with three legs. This is because of the result of a restoration. When the restorer repaired this little angel's painting, he found that the former artist painted the angel's leg in another direction and covered it up. In order to show the traces of all historical periods, the restorer repainted the little angel's hidden legs, so the little angel with "three legs" appeared to the people.[4] [4] (

Fig. 1) On the other hand, the restorer presents the entire "Stratification".

"Stratification" in this article mainly refers to the historical traces of different periods contained in historical buildings, regions or cities, including form, space, memory, culture, expression, ideology and so on.

[3] Author learned the interpretation of "memory" from prof. Laura Pezzetti, and she talked about this concept in her lecture of "Rewriting: Architecture in Historical Layering" at 25 May 2019 in Nanjing.

[4] Author read this story from Marco Triciuoglio's paper: "The Valentino's Cherub: The Italian Way to Restoration Design and a Chinese Perspective".

Fig. 1 Three legs angle in the Castle of Valentino[5]

1.1.3 Analogy of linguistic concept

Stratification and history are closely related, and each layer is a trace left by collective memory. Italian scholars choose to use the word "Riscrittura" as the idea of adding traces, which is a concept derived from linguistics and literature. Gennaro Postiglione, professor of the Politecnico di Milano, published "*L'intervento sull'esistente come 'ri-scrittura' dello spazio*" in "*Lettera Ventidue*" in 2018 ("Rewriting" the existing space intervention), he analogized all artistic practices to the process of text generation. He regarded "Reading" as an important object of artistic practice, emphasized the equivalence of the importance of "Reading" and "Writing", and introduced it into the study of architecture:

"*If the adoption of the identity between reading the text and its "rewriting" appears clear, as we have seen, when we are in the literary field, it is more complex to transfer this decoding/creation process to the world of architecture that brings with it all the heaviness of being a three-dimensional manifestation endowed with its own autonomous and hollow physical identity.*"[6][5]

Buildings have completely different physical size properties than books, and the way of "reading" is also quite different. In addition to being required to be entered, used, and felt,

[5] Picture is taken by Liu Ziwei.[4]

[6] Se l'adozione della identità tra lettura del testo e sua "riscrittura" appare chiara, come si è visto, quando si è in campo letterario, risulta più complesso trasferire tale procedimento di decodificazione/creazione al mondo dell'architettura che porta con sé tutta la pesantezza dell'essere una manifestazione tridimensionale dotata di una propria identità fisica autonoma e cava.

architecture also need to have a knowledge reserve of the particularity of the architectural discourse composition. It is also important to understand architectural works. Reading the artifacts of architecture means "deconstructing" those identifiable characteristic elements and compositional logic, so that people can understand clearly. "Reading" is not just to preserve existing knowledge, but to create "new" text content.

A city is a collection of ideas and spirits, and culture, civilization, architectural research, ideology, and so on are constantly superimposed on it. No city can be said to be completely new or completely old. Under the long-term evolution of space, related research in cities shows how the relationship between urban space and society is integrated into an organic whole object. The city itself is constantly written, covered, and modified like a "rewritten book". It Contains the dual superposition of substance and memory, and these superpositions form the "Stratification".[6, 7]

1.2 Reinterpret the Concept of “Rewriting”

1.2.1 The discussion at Imperial Examination Museum of China in Nanjing

In the *Imperial Examination Museum Of China* in Nanjing on the afternoon of May 25, 2019, Professor Liu Kecheng of Xi'an University of Architecture and Technology and Professor Laura Pezzetti of the Politecnico di Milano carried out the theme "Rewriting: Architecture in Historical Layering", and talked with many famous architecture scholars in Chinese academia, including 11 guests: Bao Li, Dai Chun, Ge Ming, Han Dongqing, Li Hua, Liu Kecheng, Lu Andong, Laura Pezzetti, Tang Keyang, Zhang Bin, Zhao Chen.

Professor Zhao Chen raised the question of how to translate the concept of "rewriting". "rewriting" or "continuing", and proposed three starting points for the discussion of

the problem:

"*... the first point is about the ARCHITECTURAL LEVEL, the difference in understanding between Italian and Chinese contexts, and the interpretation of this concept by different cultures may be different; The second point is that from the URBAN LEVEL, there is a difference understanding about Urban between the Western and China. The traditional Chinese concept of the city is also not the same as the Western, including the way of construction in modern times, and now we are in such a complex environment; The third point is AUTHENTICITY. This concept was proposed by the conservation of historical buildings in the West, and different cultural concepts have been added since the 1970s. Should we consider only material things as authenticity? Is there still immaterial authenticity? Are buildings and cities material? Is it not immaterial? ...* "[8, 9]

Since the word came from the Italian, Professor Laura first explained the word "Riscrittura". And then several Professors discussed about it and give appreciate to Laura's point. Based on their explanation and discussion, this research combed and summarized the Rewriting.

The rewriting in historical space is a specific architectural issue that we can find in various times. It can not only explain the development of architectural language, but also explain the evolution of cities. This theme includes not only the organic connection between New and Old, Eternity and Change, but also understanding of some keywords, such as Time, Memory, and History. The exploration of "Significance" is repeated in each era. The answer to this question can only be solved by studying the links between history, site, and design.

Rewriting implies that design is also an important strategy in the preservation of historical areas. In the changing economic, cultural, and functional context, rewriting links the characteristics of places with historical resources and cultural heritage by constructing multi-dimensional narratives. Rewriting is a complex topic that requires in-depth understanding and thinking, and it does not mean to rewrite history, but to build relationships between them.

[7]

Memory is a deeper content and a participant in our lives and city. "*Memory creates Rewriting.*" [8] However, how to rewrite and how to leave "traces" on existing Palimpsest is a worth discussing question. The building is not as solid as it looks, and they had been in the architect's mind for a long time before construction. After the construction were realized, they remained in people's memory, passed down from generations and injected energy into the architect's thinking. [9] We are not just talking about historical sites, but about the subtle and profound relationship between Past, Present and Future.[9][10]

1.2.2 Reinterpret "Rewriting" as Chinese

From the discussions of Professor Laura and other scholars, we can find its relationship with the "Palimpsest" and "Stratification". They emphasized that the focus of Rewriting is to establish a relationship, a relationship between the Past, Present, and Future. The intervention of Rewriting requires Reading the existing "Palimpsest" and then writing. Former Professor Postiglione has almost the same analogy.

The meaning of Rewriting appears to be less accurate in the field of architecture for several reasons: First, the meaning of "Rewriting" is "write the text again", which contains a previous error that should be fixed, but it is not a simple "erasing", which may risk being abused by ignorance of Real-estate developers and other fields; Secondly, "Rewriting" can be understood as "overlapping writing", but according to the foregoing, we know that simple overlapping writing cannot represent the most important meaning of "Rewriting", which is TO BUILD RELATIONSHIP WITH HISTORY. Combining the interpretation of the meaning of foreign literature and the reinterpretation of Chinese scholars, this study interprets the meaning of "Rewriting" as "after reading then writing". To emphasize its

[7] Author summarized prof. Laura Pezzetti's point of "Rewriting" to this part, and highlight the most important concept of it: to build relationship between design and history.
[8] Prof. Laura Pezzetti talked this concept in the lecture.
[9] Author combined the concept of "The Collective Memory" of Aldo Rossi and Prof. Laura's point.
[10] The relationship between Past, Present and Future is gotten from Prof. Laura's lecture, and she shows us the design strategy of Palazzo Arese di Seveso.

relationship with History, the complete explaining of Rewriting is "After reading then writing based on History" in Chinese.

1.3 The Relationship between the Old and the New

The relationship between the New and the Old is an eternal proposition in Italian heritage conservation. What is the New? What is the Old? In the intervention process of historic buildings, the principle of restoration requires as much humility as possible and respect for the original work. However, architects often want to leave traces of "self-creation" on the restored architectural heritage. However, how to carry out "self-creation" has become the focus of continuous debate in the field of heritage conservation.[10]

Traditional conservation theories have also had a huge impact on redefinition of the New and Old relationships, including Brandy's theory, *the Venice Charter*, and the contributions of a large number of theorists. Cesare Brandy summarized the core concepts of protection and restoration of works of art (including architecture, monuments, etc.), and he defined restoration as: "*Given the consideration of the restoration of future inheritance, from the material consistency and the duality of aesthetics and history, From a perspective, restoration constitutes a methodological part of cognitive art works.*"[11] Brandy did not define the definition of restoration as a specific operation method of an art discipline, but emphasized the cognitive process and Purpose. This is the essential requirement for restoration. Only by understanding the historical development of arts can people be better able to "read and write historical works" of arts.

The redefinition of the New and Old relationship cannot be separated from the development of traditional protection principles. Authenticity and identifiability are the two most important principles. Article 9 of *the Venice Charter* states: "*Its aim is to preserve and reveal the aesthetic and historic value of the monument and is based on respect for original material and authentic documents.* "[12]

The Authenticity of Italy is Auticitità, which is composed of autòs (in itself) and entòs (inner), thus the term

Authenticity means the true immanence beyond self-cognition. For a building, its meaning should refer to all the historical information it contains, including time, space, matter, and so on. The debate on authenticity in history has never stopped. Many people think that this is a fictional concept. There is no such thing as authenticity in architecture. People only consider this kind of history when there is a major change in style in a certain period. The information is worthy to be recorded, which is, the "authenticity" of the building, because people have no way to truly retain all the information in the long history.[13] The authenticity does not only include the meaning of the original state of the historic building, but also the subsequent reconstruction of it. In this sense, authenticity has a time dimension, so there is no strict "Authenticity", but "Authenticity" with space-time dimension, criticality and practicality.

E.N. Rogers once questioned about the relationship between design and conservation: *"to conserve or to build are two actions pertaining to the same act of awareness, since both are subjected to the same method: conservation has no meaning unless it is understood as bringing the past up to date, while building has no meaning if it is not meant as a continuation of the historical process: it is all a matter of clarifying the sense of history."*[14]

1.4 The Methods of Rewriting by Italian Architects

1.4.1 Analogical Rewriting of La Tendenza

What is La Tendenza

"La Tendenza" means "trend" in Italian, it represents a style improvement, and it mainly criticizes the avant-garde idea as impossible and unrealistic. At the 15th Triennale of Milan in 1973, Massimo Scolari published *"Architettura Razionale"*, which he used in the book to express La Tendenza's special ideas.[15] He believes that architecture should be a process of presenting the architectural ontology through self-

dominance, and the inheritance of theoretical language systems and architectural forms should be reflected in the process. La Tendenza's inheritance is also separated from rationalism. It is no longer labelled or has obvious style characteristics. Instead, it focuses on the historical environment in which Italy is located. Instead of focusing only on the building itself, they are discussing the essence of architecture, the city of architecture. Contained in the historical continuity and cultural heritage.[16]

Rationalism gradually faded out of view after the 1940s due to the collapse of the fascist regime, and Aldo Rossi and George Grassi re-examined the architectural works of Group 7 Giuseppe Terragni et al. They oppose "pragmatic functionalism", "technical determinism", and architectural design methods abducted by production and consumption, and instead emphasize the unique historical form of urban architecture, hoping to design by establishing a method that inherits historical context. "*The Architecture of the City*" and "*La costruzione logica dell'architettura*" are the works of Rossi and Grassi, and Italian rationalism has flourished after the publication of these two books. In 1973, Rossi organized the 15th Milan Triennial. This exhibition made many young designers recognize Rossi's ideas. Rossi advocated the use of a more specific working method, namely typology and rational thinking. La Tendenza movement was fully launched.

Model and Type

Model and Type are a pair of closely related concepts, people can simply understand the relationship between the Concrete and the Abstract. The Type has always been a problem for architects to study and think about. The Type is hidden in the history of architecture. The Type problem will appear when encountering urban problems. Many scholars in history have defined the Type. Any building is composed of 3 main factors, location, form and components. The concept of type is enduring and extremely complex. It is a logical principle that precedes form and constitutes form.

Quatremere De Quincy gives a very

subtle definition of type:

“ *The word ‘type’ represents not so much the image of a thing to be copied or perfectly imitated as the idea of an element that must itself serve as a rule for the model.... The model, understood in terms of the practical execution of art, is an object that must be repeated such as it is; type, on the contrary, is an object, according to which one can conceive works that do not resemble one another at all. Everything is precise and given in the model; everything is more or less vague in the type. Thus we see that the imitation of types involves nothing that feelings or spirit cannot recognize....*”[17]40

From the definition of Quincy, one can understand that the Model is a physical entity that exists in the real world. The Model exists in the long river of history. People analyze the internal logic of the abstract Model to obtain the Type. Therefore, one can say that Type is the universal form of a class of things, and its universality comes from class characteristics, which makes Type have universal significance. The Type itself as a result of abstraction does not have the meaning of historical symbols, so designing according to the Type is actually the idea of putting architecture as an eternal concept.

The role of "collective memory"

History has always influenced people's social activities by influencing people's minds, which has produced people's living environment and image of the city today. According to Aldo Rossi, the mental image produced by people is the "collective memory" of human beings. It is not the product of a certain era, but the product of the entire human civilization and environmental transformation. At each stage of history, new content is added to the "collective memory". From this perspective, it exists objectively. "Collective memory" is passed down through human language, writing, drawing, and practice.

“*One can say that the city itself is the collective memory of its people, arid like memory it is associated with objects and places. The city is the locus of the collective memory. This relationship between the locus and the citizenry then becomes the city’s predominant image, both of architecture and of landscape, and as*

certain artifacts become part of its memory, new ones emerge."[17]130

Rossi believes that the elements of typology and its choice are more important than the choice of surface layers such as style and form. For example, the type of building with corridors, the style of corridors can be completely different, but the space of corridors must exist, which is the essence of architecture. Types are composed of Lifestyles and Architectural Forms. Although the physical forms will have differences in integration under different social forms, the eternity of types is reflected in historical forms, which is the principle of forming formal logic.

Rossi's Collage Design Method in "Analogy City"

For the first time, Rossi's "*An Analogical Architecture*", published in *A+U* magazine in 1976, elaborated what he meant by "Analogy." He first acknowledged his single application of potential design methods in architectural design, which can also be said to be personal preferences and monumental thinking, but with each new intervention he was more certain that his concept originated from "*Analogy City*", so Rossi tried to transform this logical element into a design method.

In order to explain the concept of "*Analog City*", Rossi cited the painting "*Capriccio Con Edifici Palladiani*"

(

Fig. 2) by Antonio Canaletto. The painting is called "*Capriccio*" because Canareto painted a fantasy scene of Venice. He placed Palladio's Vicenza's Basilica Palladiana, Palazzo Chiericati, and another Rialto Bridge that Palladio never built in one screen.

Canaletto completed the imaginary painting after observing the whole city of Venice. At first sight of this painting, people would think that this must be a corner of Venice. The buildings in the picture show their relevance to the history of the

building and the city itself. The "Analogous Architecture" in Venice is composed of similar elements.

Fig. 2 *Capriccio Con Edifici Palladiani*[11]

Canaletto's work explains the design methods of formal logic that make people look like they are:

The elements in the design process are all established and formally very clear, but the meaning of the elements is closely related to the design technique. Only through the design method can the building be given real, unexpected and original meaning.

The replacement of the imaginary architecture and space has made the unique charm of Canaletto's paintings, and the analogical artistic expression is most prominent here. History is not simply stated, but commemorated or used.

According to Rossi, the more complex meaning of "analogous architecture" can be gleaned from the way of "analogizing cities". It is a design, meaningless. It is a product of traditional technology, but it requires new technology when it represents any type of element. Collage is this new technology. Although people understand the mechanics of collage, its ultimate meaning is unknown.

Rossi's "*LA CITTÀ ANALOGA*" at the Venice Biennale

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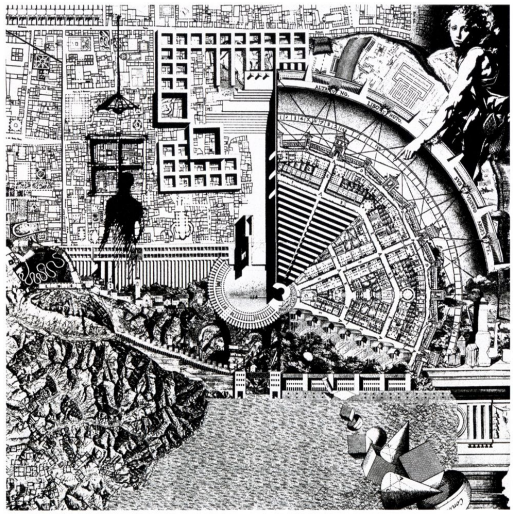

Fig. 3) proves this very well. "*This work is not an explanation of analogy cities, but also because we don't believe in explanations.*"[18]

Rossi wants to warn anyone who believes that they can learn specific design methods in "*Analogy City*", because this picture is only used by Rossi to express his ideas. From the

[11] https://it.wikipedia.org/wiki/Capriccio_con_edifici_palladiani#/media/File:Giovanni_Antonio_Canal,_il_Canaletto_-_Capriccio_-_a_Palladian_Design_for_the_Rialto_Bridge,_with_Buildings_at_Vicenza_-_WGA03938.jpg

classical period to the modern classic architectural prototypes, he combined them into a beautiful fantasy picture. The city acquired the characteristics through the placement of these monuments, which is the perfect urban form in Rossi's heart. It can be seen that Rossi analogizes Canaletto's painting style.

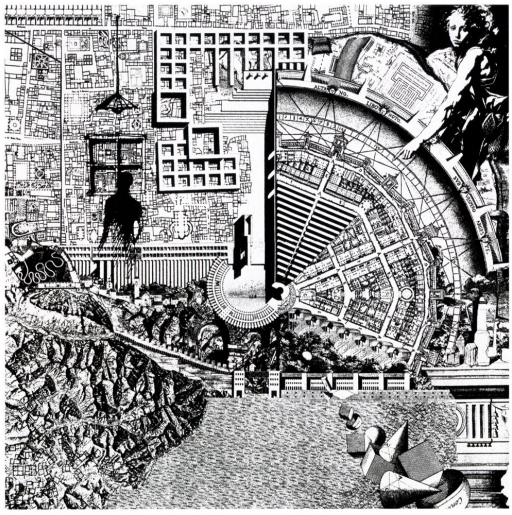

Fig. 3 *LA CITTÀ ANALOGA*[12]

Rewriting the Teatro Carlo Felice

Teatro Carlo Felice is a famous opera building in Genoa. It was built on April 7, 1828 and was designed by the famous Italian architect Carlo Barabino.

After more than 100 years of standing in Genoa, due to the destruction of the Second World War, the theater left only the side porch and surrounding colonnade in the direction of Genoa's central square. The theatre was unable to carry modern functions, so the municipality decided to restore the theatre. A new competition was launched in 1981, with architects Aldo Rossi, Ignazio Gardella and Fabio Reinhart winning the competition.

The municipal authority put forward planning requirements for the design: first, the Doric mountain gate colonnade with original relief decoration needs to be protected; second, the gray space square behind the porch needs to be transformed. This space should have been a node of Piazza De Ferrari and the Galleria Mazzini.

In addition, the project also requires the transformation of the exterior space of the building facing the square, and the reconstruction of the mass of the southeast side will add a

[12] A.Rossi, La città analoga, tavola in «Lotus», n.13, 1976, pp. 4-7

tower, which will be twice the volume of Barabino's design, The tower will house stage equipment including new technology, changing rooms, test rooms, and more. The gray material part of the tower represents the stage space, and the beige material part above represents the rehearsal room and the machine room.

Fig. 4Teatro Carlo Felice in 1828[13]

Fig. 5 Teatro Carlo Felice at now[14]

The pictures (

Fig. 4;

Fig. 5) shows the contrast effect before and after the renovation of the Carlo Felice Theater. It can be seen that the tower is divided into three sections on the inside, the lower section uses the same stone veneer as the ground floor, and the upper and middle floors use different materials. The lower section is intended to reflect the height of the previous volume of the theater. The upper floor Rossi used a huge cornice that he picked out, and he hoped that the theater show would be displayed in the city in the form of a "memorial", which is also one of his ideas.

[13] http://www.genovacollezioni.it/img/post-images/41590.947763287/41590.947763287-full.jpg
[14] https://www.archilovers.com/projects/207395/ricostruzione-teatro-dell-opera-di-genova-carlo-felice-piazza-de-ferrari-genova.html#images

Rossi retains the "Stratification" of the original theater, including repairs to the damaged Doric colonnade and side porches, etc., while reconstructing some of the traces according to Barabino's original drawings. By redesigning the gray space behind the ground floor porch, Rossi connected the Ferrari Square with the Mazzini Museum of Art, and at the same time placed elements of the glass tower symbolizing the port lighthouse, so that people can be evoked memories of history. During the day, the gray space gallery at the bottom relies on the glass minaret on the top for lighting. At night, the minaret becomes a lighthouse for the port, shining in the city.
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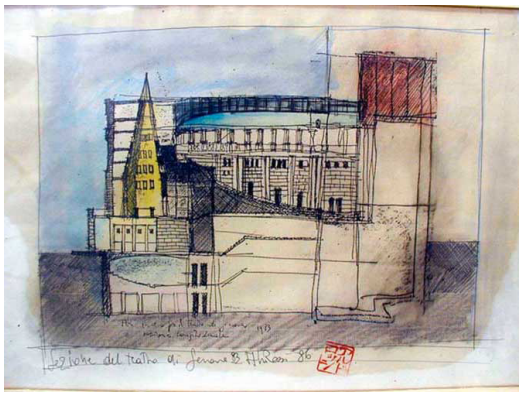

Fig. 6)The auditorium of the theater is different from other theaters. It is more like a living room in a city square.
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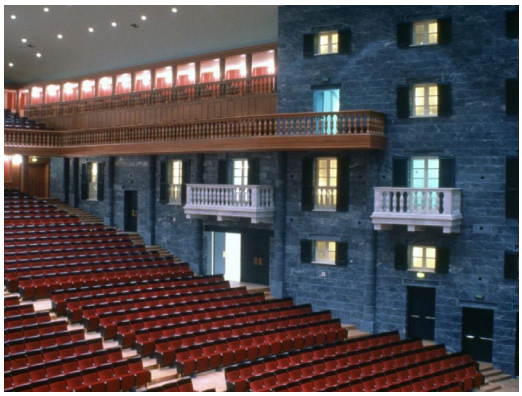

Fig. 7) The sides of the building are decorated with marble facades and windows with balconies. The people inside are like watching the street view. The interpenetration of indoor and outdoor expresses Rossi's architectural urbanization thought, and this is also a way to translate Rossi's translation of history.

We can find similar interventions in Carlo Aymonino 's renovation project of Palazzo di Giustizia, Ferrara. It is also a renovation project combining the Old and New in a historical area.
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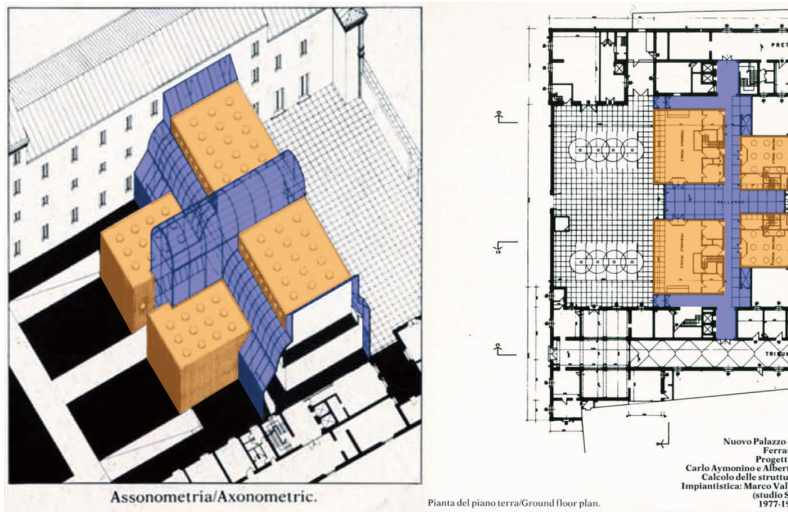


Fig. 8;

Fig. 9;

Fig. 10)

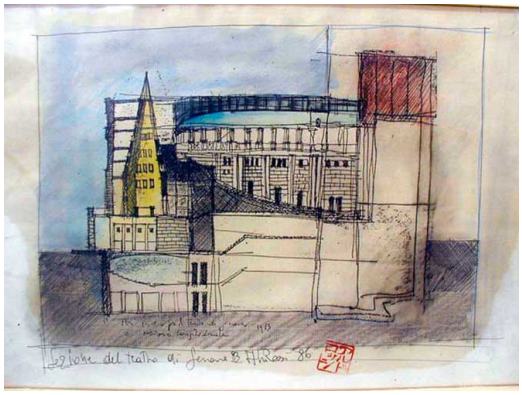


Fig. 6 Rossi manuscript-section[15]

Fig. 7 "Street view" inside the theater[14]

[15] https://www.fondazionealdorossi.org/opere/1980-1989/teatro-carlo-felice/

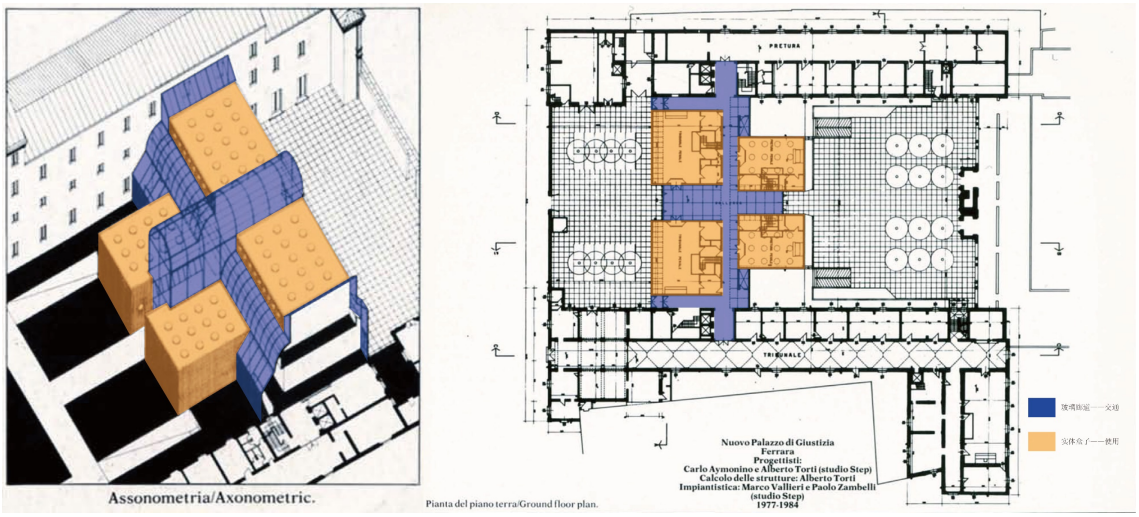


Fig. 8 Palazzo di Giustizia, Ferrara Renovation Project Axonometry & Plan[16]

Fig. 9 Entrance[16]

Fig. 10 Glass gallery[16]

1.4.2 Stratified Rewriting of Carlo Scarpa

Impact by historical cities

Carlo Alberto Scarpa was born in Venice, Italy, in June 1906. His father was a middle school teacher and his mother was a fashion designer.

[16] The basement comes from 《*Carlo Aymonino : officina ferrarese. Nuovo Palazzo di Giustizia, 1977-1984, Ferrara - Fotografie di Gabriele Basilico / Francesco Moschini*》

When Scarpa was two years old, because his mother opened a clothing design shop in Vicenza, he moved there with his family and spent his childhood in there. His mother died in early 1919, and Scarpa returned to Venice again.

Vicenza

Vicenza is known as the city of Palladio. Palladio has left a rich architectural heritage in this city. There is more than a dozen of his works in existence, and his statue stands in the center of the city, on the Piazza dei Signori Vicenza. Scarpa was influenced by the classic atmosphere here, and formed his initial understanding of architecture, which also made him addicted to classical materials. His *Banca Popolare di Verona* is the best inheritance of classical architecture.

In addition to classics and craftsmanship, Vicenza also gives Scarpa a real terrestrial feel, which is a sharp contrast to Venice. Scarpa mentioned in the interview that he seemed a stranger to Venice, but for Vicenza, the city gave him an initial understanding of architecture. Since childhood, Scarpa has played under the corridors of *Villa Almerico Capra* in the suburbs, overlooking the hills, fields and mountains. At the same time, he also had the opportunity to play in the grandfather's house. Scarpa was deeply impressed by the rural scene.

Venice

Venice is a maritime city that has fascinated the whole world. It has a history of more than 1,300 years. It combines East Roman Byzantine culture with Western Roman Empire culture, forming a free and open urban character. The winding lanes and narrow lanes, the square space that is suddenly open, and the waterways of the capillary channel form the unique space texture of Venice. In San Marco square, people can see Byzantine, Gothic, and Renaissance in one picture building.

The Venetians attached great importance to their history and were even proud of it. They valued traditional architecture as treasure. Scapa is also the same. The reflection of time is reflected in his architecture. The respect for tradition and the change caused by the passing of time are his responses to this thinking.

Stratified thought in renovation project

Scarpa attaches great importance to the relationship between architecture and the environment, as well as the influence of light and shadow on architectural space, which are derived from the influence of Louis Kahn and Frank Wright. Scarpa's projects are not large, but because he pays great attention to the details of his works, each project has taken him at least five years. Scarpa often separates himself from the modern vocabulary. He learned through his own artisan consciousness and became an independent architect in Italy. For him, the construction process is not a process of handing over drawings to construction workers, but a process of creating with infinite variables.

The reason why Scarpa has been valued by the academia in modern times is that, after the large-scale construction in the West, the transformation of historical buildings has become an important task that architects have to face. To some extent, it gave direction to the transformation of historical buildings. Scarpa has his own understanding of the transformation of historical buildings. He will personally carefully survey the remaining buildings, clarify the context of history, and present the architectural elements of different periods in a hierarchical manner, which is the "Stratification" described earlier. This "Stratification" is the charm of historical buildings. Scarpa believes that the conservation and transformation of historical buildings is not simply to preserve the status quo, the pursuit of original authenticity in the original sense is meaningless. For the chaotic part of the " Stratification", Scarpa has the courage to choose to demolish. This demolishment is to better sort out the history in the space and present the state of different historical interweaving.

Rewriting the Castelvecchio Verona

This castle was built by the Scaligeri Family to defend the resistance of Verona citizens. The Scaligeri Family built castles on both sides of the city wall. Because its defensive function is enough, the old city wall is not so important. Therefore, the family built a new city wall in the larger outer circle in the later period. The original function of the city wall has changed from external to internal citizens. The Ponte di Castelvecchio is a private bridge built by the Family. The other

end of the bridge is the territory of the allies, which can be evacuated in an emergency.

At the beginning of the 19th century, Verona was occupied by Napoleon's army. Since the Scaligeri Family only needs to defend the people to the south, while all the allies are to the north, the land along the river is empty. Napoleon built a new castle in the part along the river. We can see an L-shaped plane, which is used as a stable for soldiers and soldiers. It later became the museum's main exhibition space.

The Verona Museum's nearly 200-year history belongs to the French in a way. After the First World War, the Italian army left here and headed for the Alps. Verona was no longer a frontline city, and the castle ended his last historical period in modern times. The elevation in

Fig. 12 is the newly inserted elevation after completely peeling off the elevation in

Fig. 11. Because the government decided to change the castle into a museum in the early 20th century, the doors and windows in Figure 4 and 5 were rescued from the flood of the Adizi River in 1882. This is a fake-façade that is symmetrical about the center axis after the transformation. The entrance to the museum is in the middle, and the original training ground is turned into a garden with a fountain. The large staircase built during the Napoleonic period still exists, it is for the soldiers to climb up the city walls against the Austrian military stairs.

At the end of 1950, Licisco Magagnato took over the chairmanship of the Verona Municipal Museum of Art, and in 1956 he took over the director of the Verona Castle Museum. Come and carry out the renovation of the Castelvecchio Verona.

Fig. 11 Barracks after the withdrawal of the Italian army, 1923[17]

Fig. 12 After transformation, 1926[17]

With the discovery of the archaeological excavations at Porta del Morbio, the design strategy of the castle has changed qualitatively. He reopened the door and raised the height of the bridge so that it could be used as a passageway. He used steel and concrete as materials to raise the bridge.

Fig. 13 clearly shows the relationship between the newly built bridge, the ancient city wall and the Porta del Morbio. After discovering it, Scarpa has been trying to separate materials from different periods from the old city walls. He hoped that visitors could see the oldest structure on the scene. It can be clearly seen in the picture that in order to make the streamline smooth, he increased the height of the original bridge by nearly 2m, so that people can feel the "Stratification" of history at this node.

[17] The pictures come from《*Carlo Scarpa and Castelvecchio Revisited*》

Fig. 13 The relationship between the Porta del Morbio and the passage design

On the other side of the door, Scarpa wanted to open the corner of the building in order to expose the moat. He chose to demolish the Napoleon-era staircase and a part of the building next to it. He was acutely aware that Napoleon's stairs were not important at all compared to the full expression of the original wall. Scarpa cut the roof orthogonally, and added a green tube roof under the original Roman period shingles. At the same time, an inclined beam was inserted into the roof from the ancient city wall.

All of this series of operations are for one purpose, to highlight the *Equestrian Statue of Cangrande Della Scala* of the whole museum. Scarpa used a conversational approach to let people experience the statue, which is a way to make people space participants, at different elevations and directions.

Fig. 14 Five Scarpa's indoor "secondary facade" sequences

Fig. 16 Statue node after Scapa's transformation

Fig. 17 Main façade of the Castle

Regarding the facade before the transformation, according to the foregoing, it is known that this is a fake facade. The first thing that Scarpa thought of when he started the design was to delete this facade, but Magagnato stopped him, so this scarred façade is therefore preserved.

Fig. 15 Stairs built during the Napoleonic period[18]

Scarpa had amazing thinking about this facade. In order to show his attitude towards this fake facade, he invented an indoor "secondary façade". As can be seen in, Scarpa has a guide wall at the entrance of the first floor. (This element is also used in the entire museum's visitor flow)

This wall extends from the "secondary façade" of the interior to the outside, and separates the entrance and exit with an L-shaped wall. The feeling of the entrance and the exit is also quite different. The entrance is a guide wall, and the exit is a box form, which visually blocks the original facade. When people come to the interior, they can see the five "secondary façade" sequences designed by Scarpa:

The first sequence is a box with a skylight protruding from the facade;

[18] The basement comes from 《*Carlo Scarpa and Castelvecchio Revisited*》

the second and fourth are recessed square glass windows; the third is the recessed glass facade with the original center of axial symmetry; the fifth It was Scarpa's sliding steel doors carefully designed for the museum.

It can be seen that when setting up the "secondary facade", Scarpa tried to avoid using a completely symmetrical classical composition, but instead used steel bars to break the original order and seek a tension between the New and the Old.

1.4.3 High-tech Rewriting of Renzo Piano

The Relationship between Piano's View of Technology and History

On September 14, 1937, Renzo Piano was born to a builder's family in Genoa, Italy. His grandfather, father, four uncles, and an older brother were all building contractors. He grew up as an architect in this family environment.

Before graduating from Politecnico di Milano in 1964, Piano had been working in his father's construction company, under the direction of Franco Albini to study architectural design. He worshipped Brunelleschi very much, he also admired Jean Prouve in France, and because of his relationship, Piano was able to work at the studio of Louis Kahn and Z.S. Makowsky in London.

Piano is an architect who does not pay attention to theory and is diligent in practice. He has summarized two reasons for himself: First, he loves the process of construction. The studio he founded later in his career is called RPBW, which means Renza Piano Building Studio, which also expresses his attitude and interest in the construction process. Piano attaches great importance to the use of materials, as well as the use of new technologies. Compared to wood and stone, he uses more materials for metal and glass. He used much more technology late in his career than at the Pompidou Centre, known as the masterpiece of the “High-Tech”.

The second reason is that he has never been interested in studying the so-called architectural theory and ideology. He, like today's architects, thinks it's unwise to label yourself dogmatically. "*My interest in*

craftsmanship has kept me aloof from academics."[19] In the discussion of Vittorio Gregotti and Piano's hierarchy, Gregotti even mentioned that Piano was clearly "*Anti-theoretical*" posture. Piano himself has acknowledged that this is part of the reason he has worked successfully with clients like Fiat and IBM. "*Some people have publicly stated that they believe me so much because I seem less neurotic.*"[19]

Under this premise, Piano's attention to technology and materials caused him to be labeled as a "high-tech group", but he himself did not agree with that. Piano is a man born in Genoa. He has a profound accumulation of history. This accumulation is not evident in his early works, but throughout his architectural career, we will find that he pays more attention to the Essential of architecture in his later career.

He has put forward his views on the propositions of "innovation" and "history". Piano believes that "judging something according to theory" or "completely falling to one side" is a bit too simple, which is similar to the idea that contradictions in architecture should not be recognized but should be eliminated. The contradictions between history and innovation and between the past and the future are superficial. The contradictions between tradition and innovation are bound to be accepted by people as history advances. It is pointless for an architect to choose between respect for history and innovation, just like the choice between the well-known rules and freedom, choosing either side is extremely ridiculous. Piano believes that the contradiction in the city needs to be created to solve, and express his own cognition in his own way. This contradiction should be acknowledged rather than ignored.

Rewriting Harvard Art Museum

Compared to doing projects in Italy, Piano ’s commissions and bids are more from an international perspective. The renovation of the Harvard Art Museum is a very important project for Piano because it involves processing of a large amount of historical information.

The Harvard Art Museum is part of Harvard University. It consists of

three museums and four research centers, the Fogg Museum, the Busch-Reisinger Museum and Arthur M. Sackler Museum; Archaeological Exploration of Sardis, Center for the Technical Study of Modern Art, Harvard Art Museums Archives, and the Straus Center for Conservation and Technical Studies.[20]

Since the existing functional space could not meet the needs of modern museums, the museum began expansion in 2006 and was designed by Renzo Piano. The reconstruction and expansion of Piano on the basis of three museums, Piano's biggest challenge is to choose and deal with "innovation" and "history":

How to ensure the historicity of the old Georgian-style architecture, while also implanting the innovation of modern space?

In addition, since this building is adjacent to Le Corbusier's first and only design in the United States, the Carpenter Center for the Visual Arts, how to handle the relationship with it is also a problem. You can first see the actions performed by Piano through the satellite image. (Fig. 18; Fig. 19)

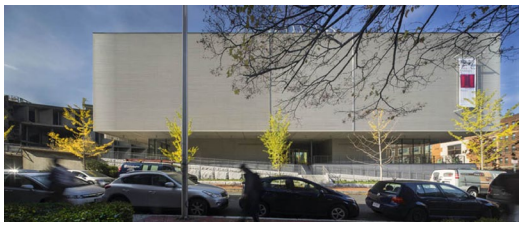


Fig. 20 Museum ramp system[20]

Fig. 18 Master plan of the Museum in 2008[19]

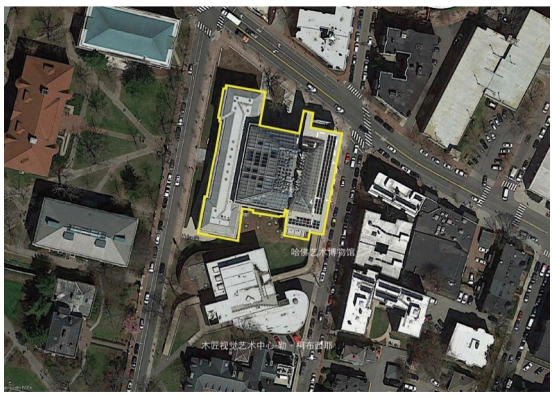


Fig. 19 Master plan of the Museum in 2018[19]

[19] The basement comes from Google Earth

[20] RPBW (www.rpbw.com)

According to the comparison chart between 2008 and 2018, it can be found that Piano has basically maintained the original morphological characteristics. From the change in the roof, he can see that he implanted a huge glass box in the middle with a thin slit in the middle. The building on the left has basically retained its original form, and the building on the right has been appropriately expanded. From the previous, he is an architect who knows from the material. He tried to "Rewriting" through the implantation of modern technology. His "Rewriting" attitude at Harvard University allows people to clearly see the "Stratification" of history.

First, he dealt with the relationship with Cobb architecture: he extended the ramp connecting the historical museum to the visual center and passed through the museum itself, so that people were the first to follow the ramp to notice the visual center behind the museum. His intervention put the converted museum in a humble state and set an accessible entrance in the middle of the ramp to enhance the building's accessibility. (Fig. 20)

For the renovation of the entire museum, Piano chose to unify the three historical and art museums under a triangular glass roof and tightly bind the three together through the stability of the triangle. At the same time, Piano attaches importance to the relationship with historical buildings. He remains the original state on the ground and first floors as much as possible; on the third and fourth floors, he chooses to introduce light into the interior and continue the characteristics of the courtyard space, making the indoor experience richer.

ig. 21 The perspective of the Entrance[21]

Fig. 22 Museum South Facade Part[21]

[21] The basement comes from RPBW

Piano's operation is very simple, and its "Stratification" can be clearly identified through the perspective of the entrance: (ig. 21)

The yellow line is the newly constructed part of Piano's intervention, and the white dotted line is the facade of the preserved Georgian building. Fig. 22 is the most typical part of the museum renovation. Piano set up a narrow glass band as a service space (red line part) to clearly define the new part (yellow line part) and the historical part (white dotted line). The "Stratification" is made accessible to ordinary people through the façade.

The core space of the whole museum lies in the atrium part, in which Piano has a modern and historical dialogue. As can be seen from Fig. 23, Piano retained the Georgia-style arches on the first and second floors, and rebuilt the third and fourth floors. The skylight is introduced into the room through the glass roof through the glass porch. Through the photos in Fig. 24, we can find that the line between the second and third floors is like a dividing line, which clearly defines "traditional" and "innovation":

Traditional Arcades in the lower part, Intricate Metal Chandeliers, Grids and Glass Ceilings in the upper part.

But at the same time, Piano also

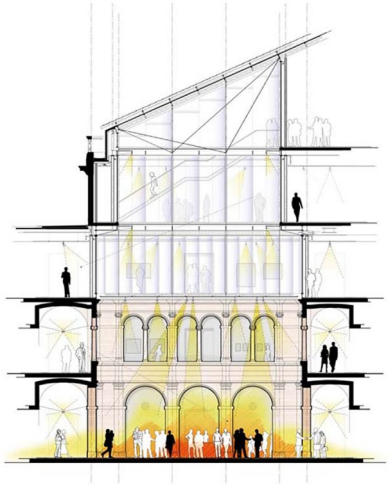


Fig. 23 Manuscript section of the courtyard[20]

Fig. 24 Perspective of the courtyard[20]

blurred the relationship between the "New" and "Old". It can be found that he has also carefully inserted many modern elements on the first and second floors, such as dark gray floor, light yellow wall surface, warm-colored spotlights and so on. On the third floor, you can see the gray wall echoing the lower arcade, which is also a warm-colored spotlight, the statue's placement, and a complete round strip. All the processing makes the space of the atrium harmonious and natural, and people will be more willing to stay here to feel the cultural impact brought by the "Stratification".

Piano likewise applied his understanding of traditional arches to the layout of the gallery. Figure 4-27 shows the effect and analysis of the museum gallery. Piano extracted the archetype's prototype. Through his knowledge of material technology, he designed the suspended ceilings as a semi-arc-shaped supply ceiling. Each hanging plate is like limiting a display space. People also experience the state of dialogue with history in this gallery. (Fig. 25)

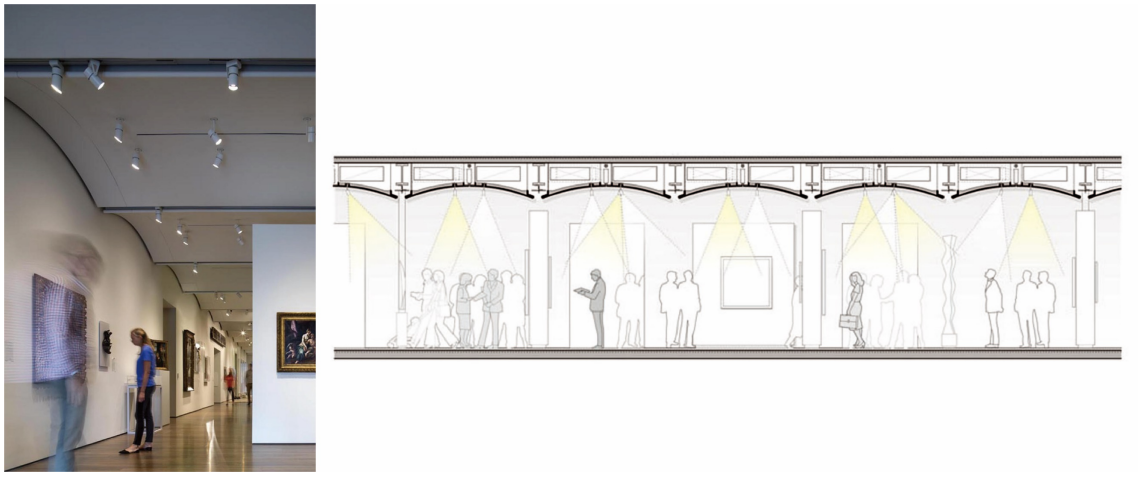


Fig. 25 Museum gallery perspective and diagram[20]

Chapter II Analysis of Space Development of Fenghuang Town

2.1 The Background of Fenghuang Town

2.1.1 Location

The Fenghuang Town is located in Zhashui county, Shangluo city, Shaanxi province, about 45 kilometers away from Zhashui city. It is located at the south of Qinling mountains, middle of Shechuan river, and the intersection of Zaohe river, Shuitangou river and Shechuan river.[21]

The administrative area of the town is 163 square kilometers and the cultivated land is 15400 mu. Town government resident is also called Feng Town, about 45 kilometers away from Zhashui city, about 107 kilometers away from Xi 'An, the Luozha highway longitudinally through the town, Kuanfeng, Zaofeng four level roads horizontal connection north and south. The Town's external traffic is convenient.[22]

2.1.2 The History Development

The Fenghuang (means Phoenix in English) Town was first built in the Tang Dynasty and flourished in the Ming and Qing Dynasties. Since the Tang Dynasty, it has experienced ten periods including the Five Dynasties, the Song Dynasty, the Liao Dynasty, the Jin Dynasty, the Yuan Dynasty, the Ming Dynasty, the Qing Dynasty and the Republic of China. The ancient town was formed in the 8th year of Wude of the Tang Dynasty (625 AD). The first 53 families from Wu, Chu and other places settled in Fenghuang Town, then known as "Sanchahe Kou"(三岔河沟), and gradually developed. During the Ming and Qing Dynasties, mules and horses were opened and waterways were used for shipping, and commerce began to

flourish in this period. Until the period of the Republic of China, Fenghuang Town was an important trading town. Later, with the decline of water transportation and the improvement of road traffic, the ancient town lost its former status, but its features, street space texture, a large number of ancient shops, ancient residential buildings have been completely preserved.[21]

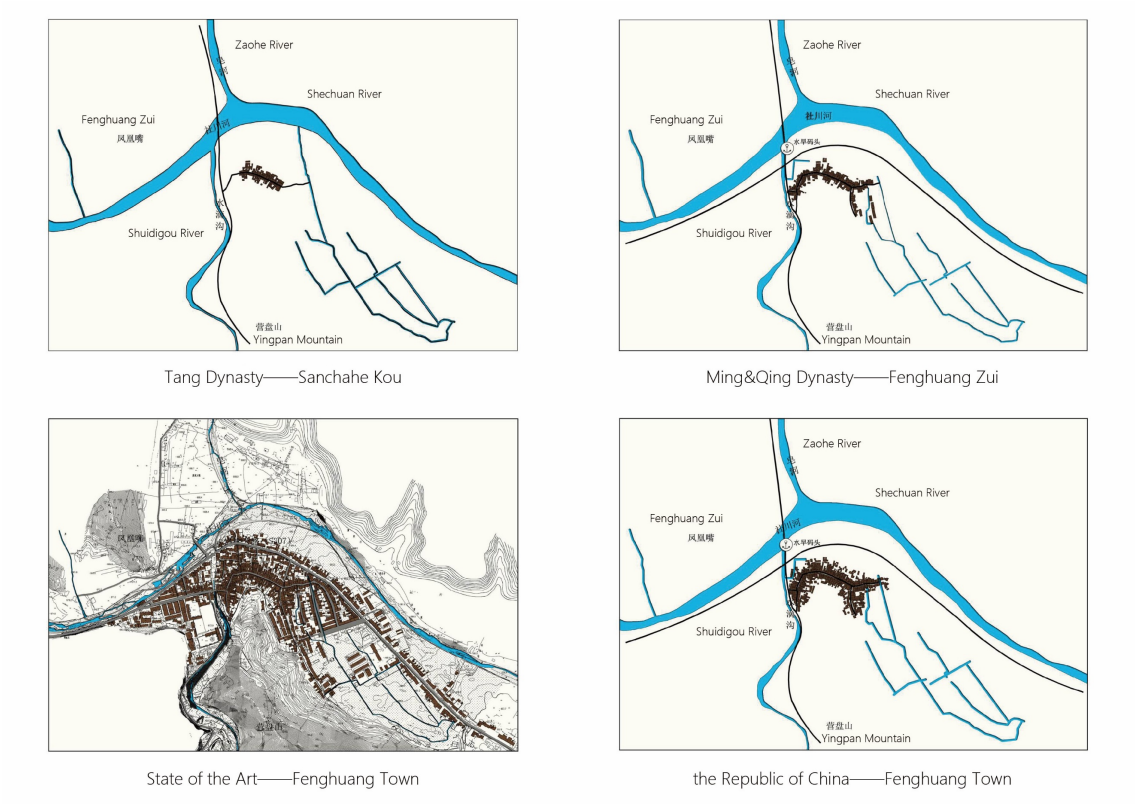


Fig. 26 The Change of the Fenghuang Town in history[22]

In the late Ming and early Qing Dynasties, the peasant rebels led by Li Zicheng fought with the Ming army here for more than ten years, resulting in a tragic scene, which resulted in a heavy blow to the development of Fenghuang Town. By the time of Shunzhi of the Qing Dynasty, the productivity of the ancient town gradually recovered. Because the water transportation here is developed, which has the natural superiority for the goods transportation, therefore it has attracted the Yu, the Hubei, the Sichuan and so on the merchants to

[22] Picture source: From 2012 Fenghuang Town Cultural Relic Conservation Plan and modified by author.

come here to purchase the land and manages the business, gradually settled down at here.

In the 14th year of the reign of emperor Kangxi of the Qing Dynasty (AD 1741), in September, Wu Sangui fought against the Qing Dynasty in Yunnan province. Wang Fuchen, which was the governor of Shaanxi province, attached to Wu and helped Wu Sangui eliminate "She Chuan Li" (today's Fenghuang Town) for the crime of "Li Zicheng's Lair". After that, the department of household discuss Shangzhou and its place call reclamation, Hubei reclamation people began to live and breed in the Sanchahe estuary. From this period to the thirty years of Qianlong, the Qing government issued many immigration orders, such as "Reclamation Order" and "Order To Move To The Sea", and adopted forced means to immigrate, so that a large number of immigrants from Huguang and other southern areas in southern Shaanxi gathered here to settle. In order to encourage the development of production, the Qing government also implemented the policy of tax reduction and reduction, so that the productivity of the area quickly recovered.

In the 13th year of Jiaqing (AD 1808), Kang Yongsheng, a descendant of Kangmaocai from Jinling, settled down in "Shangmengli" (today's Fengzhen street) with his family, bought lands and built houses, invited merchants and craftsmen, opened the mule and horse road, money river road shipping, opened the flow of commerce, people, logistics, and own more than 100 street houses. Freight to this point and then through water transport to Hubei and other places, business travel more gathered in Fenghuangzui, business prosperity, known as "Little Shanghai". By the end of the Qing Dynasty and the early years of the Republic of China, it had become a commercial port, shops and Banks all over the place, with a total of 32 large businesses. Fenghuang town has gradually become an important trading town connecting the Yangtze river system and the Yellow River system in the area south of Qinling Mountains. At this time, the mountain products of the north by the horse gang over the Qinling Mountains, turn along the waterway Hanshui transport to Hankou though here. Silk and rice from the south of the Yangtze river were transported here by water. Then they took the land route and crossed the Qinling Mountains to Chang 'An

(Now Xi'an). At the height of the boom, more than 200 cargoes transited at the terminal every day. During this period, the space of Fenghuang Town was further developed, the scale was expanded, the number of streets was increased, and houses and shops were everywhere.

In addition to immigrants from the south, Fenghuang Town was also home to immigrants from Hongdong county in Shanxi Province during the Ming and Qing Dynasties, then known as the "northern people," and hungry people who fled other areas during the drought. Therefore, Fenghuang Town has become an area where people from the south and the north live together. The cultures of the south and the north gradually merge here and form the unique folk culture of Fenghuang Town.[22]

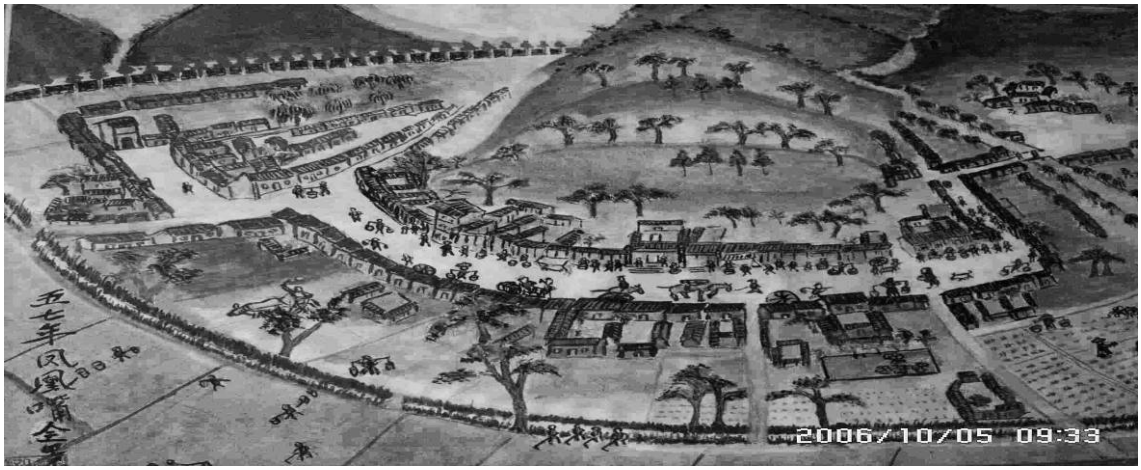


Fig. 27 The Fenghuang Town in 1957[21]9

2.2 The Characteristics of the Urban

2.2.1 The Fengshui of Fenghuang Town[23]

Fengshui (风水), defined in Chinese Dictionary "Cihai" as: "Fengshui, also known as Kanyu (堪舆), a superstition in Old China that believes the trend of

[23] After reading prof. Laura Pezzetti's book, "Layered Morphologies and Latent Structures: Reading, Decoding and Rewriting to Enhance Historic Rurban Landscape", then the author get inspired about the Fengshui Theory, and then analyzed the Fengshui of Fenghuang Town according to the method of "Dragon(Mountains), Sha(Hill), Shui(Water), Xue(Hole) and Xiang(Direction) (龙、砂、水、穴、向)".

wind and water around a residential base or graveyard can lead the fortunateness or disaster to them."[23] Before the Republic of China, Fengshui had been an authoritative theory on the choice and construction of cities, buildings, cemeteries, and their environment that prevailed among the royal family and the folk.

"Fengshui for Searching Location" focuses on the integrity of the landscape, forming a set of selection procedures from regional to local, macro to micro, which is a comprehensive process with the goal of finding vitality. For the sake of observation, Feng Shui theory breaks it down into five elements. "For summarizing, it is Qi(气); for separating, they are Dragon(Mountains), Sha(Hill), Shui(Water), Xue(Hole) and Xiang(Direction) (龙、砂、水、穴、向)" (《重校古本地理雪心赋》).[24] "Fengshui for Searching Location" revolves around five aspects, which is, "seeking the Dragon (Mountains), inspecting Sha (Hill), observing the Water, pointing the Hole and selecting Direction."(寻龙、察砂、观水、点穴、立向) Specific to the operation steps, basically following the three steps of "Seeking the Dragon (Mountains)- Get to the Point-Selecting Direction"(寻龙、点穴、立向), while the others(察砂、观水) run through it. Fengshui in Fenghuang Town can also be analyzed reversely according to this operation step.

Seeking the Dragon & Inspecting Sha

"Dragon" means a special kind of mountain range. Because the ancients marveled at the variety of forms and magnificence of certain mountain ranges, the ancients used the name "Dragon" to distinguish them from other mountain ranges. The most important characteristic of "Dragon" is vitality. The ancients believed that it had an important influence on the good and bad. "Dragon" has many branches and takes the form of human blood vessels and veins. Its source is the Kunlun Mountains in China. It is divided into three main mountain ranges, namely "North Dragon", "Middle Dragon" and "South Dragon"(北 龙 ， 中 龙 ， 南 龙). The mountain range around Fenghuang Town is derived from "Middle Dragon", the most important among the three "Dragons", which is the "Dragon" of

Xi'an, the ancient capital of the sixteen dynasties.

Fig. 28 " The Three Gan Dragon" of China[25]

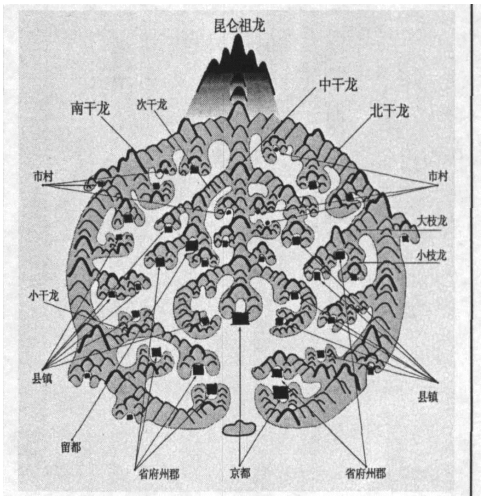


Fig. 29 Fractal & Isomorphism of Fengshui[24]

"Sha" refers to other mountains relative to "Dragon". "Inspecting Sha" in Feng Shui mainly refers to investigating the spatial relationship formed between "Xue" and the surrounding mountains. "Sha" is the guard of "Xue". Fenghuang Town does not exist as a very important city, and

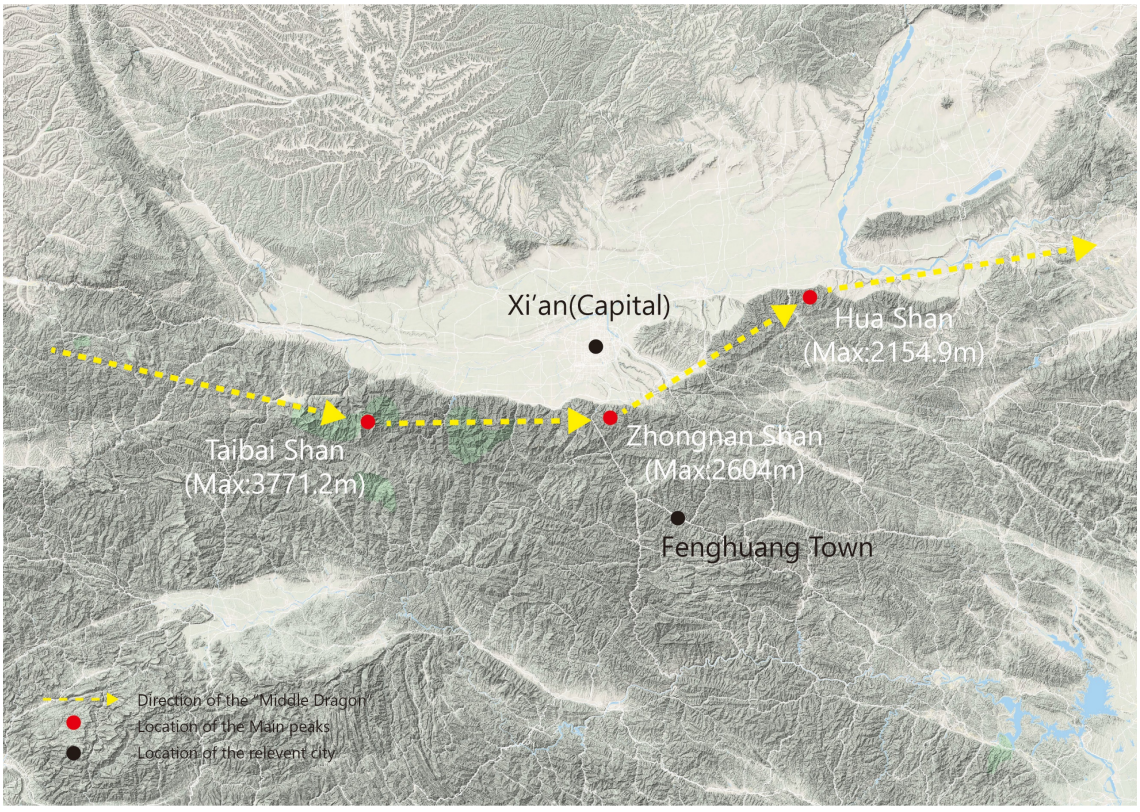


Fig. 30 The relationship between "Middle Dragon", Xi'an and Fenghuang Town[19]

its mountain range exists as a guard of the "Dragon" in the Xi'an, which is called Qinling Mountain Ranges(秦岭山脉), "Sha". The most important "Dragons" around Xi'an are Taibai Mountain(太白山), Zhongnan Mountain(终南山), Huashan Mountain(华山), etc. The mountain range of Fenghuang Town comes from the branch of Zhongnan Mountain.

"Guoxia"(Crossing the Gorge)(过峡) is the intermittent junction of the transformation of the "Dragon". Fengshui theory believes that the beautiful "Gorge" can bring good luck, so most of the habitats are selected in the "Guoxia". The "rise" and "fall" of the small mountain in "Xia"(Gorge) are also called "Zhusi"(Spider Silk)(蛛丝) and "Maji"(Horse Trail)(马迹), respectively.[26, 27] Fenghuang Town is located in a canyon between two "Sha". The Yingpan Hill could be called "Spider Silk", and the Shechuan River is called "Horse Trail".[24]

The most important step in the "Inspecting Sha" is to determine the "Sha" in the front, back, left, and right directions of the site and name it with the "The Four Symbols"(四象): The front of "Xue" is called "Counter Mountain"(案山), the distant mountain is "Chao Mountain"(朝山), and it is collectively called "Zhuque Sha"(朱雀砂); the left is "Qinglong Sha"(青龙砂); the right is "Baihu Sha"(白虎砂); the mountain range behind the "Xue" is the "Dragon", which the ancients called "the Parent Mountain"(父母山); In order to cooperate with the " The Four Symbols ", Feng Shui Theory refers to all "Sha" in back direction as "Xuanwu Mountain"(玄武山).

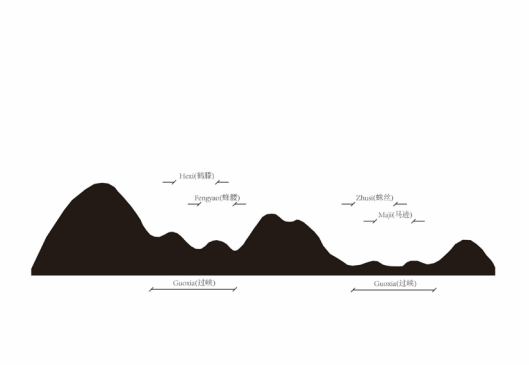


Fig. 31 Diagram of Guoxia of the Dragon

The ancients described "Zhuque Sha" as "Counter Mountain", which means that the noble deal with affairs at the counter. The small mountain on the north side of Yingpan Hill in Fenghuang Town is "Zhuque Sha". Its function is to guide the flow of river water, thereby defining the space of "Xue". The function of "Qinglong Sha" and "Baihu Sha" in Fenghuang Town is to gather rivers in "Xue", and the mountains on both sides form a surrounding trend. It can be seen that the three rivers are finally classified in

the ancient town. The "Xuanwu Mountain" in Fenghuang Town is the mountain range in the south. It belongs to the Zhongnan Mountain Range in the north. The ancients believed that the city's fortune mainly depended on this "Dragon" mountain range.

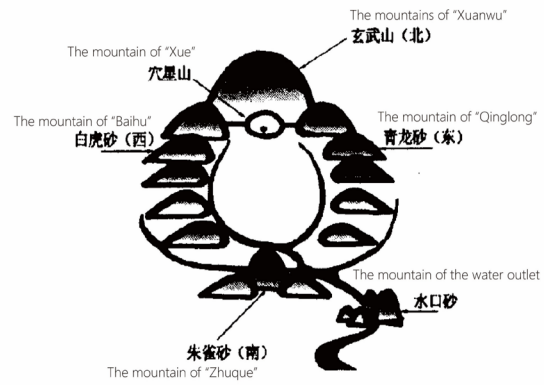


Fig. 32 The Four Symbols of "Sha"[24][24]

Fig. 33 The Four Symbols of "Sha" in Fenghuang Town[19]

Observing the Water

In Feng Shui theory, "Observing Water" has an extremely important position, and the importance of water surpasses the mountain to a certain extent. For architecture, the most important thing about "Observing Water" is to observe the flow of water. Feng Shui theory refers to "Jiao Suo Zhi Jie"(交锁织结) as four morphological features of flow of water that can bring good luck: "Jiao"(Cross) means that the two flows will cross; "Suo"(Through around the mountain) means that there would be "Sha" where the water flows out; "Zhi"(Windingly) means the direction of the water flow like the trend of weaving; "Jie"(Together), that is, the various waterways gather together to form pools, lakes, etc.

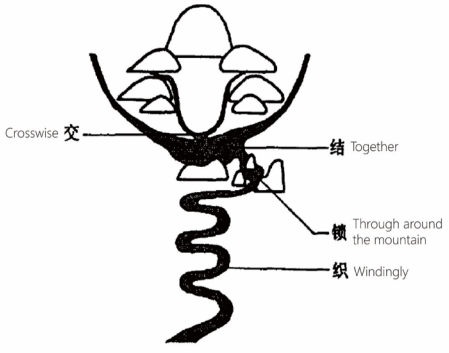


Fig. 34 Four type of flow of water about "Jiao Suo Zhi Jie"[24][24]

There are three main rivers around

[24] Modified by the author

Fenghuang Town, namely Shechuan River, Zaohegou River and Shuidigou River. Shechuan River is the main river in Fenghuang Town, flowing from west to east, and the rest of the rivers flow from the mountain into Shechuan River. Because the water shapes of these three rivers are variable and come from different directions, they eventually converge on the back side of Fenghuang Town, and the advantages of "Jiao Suo Zhi Jie" feng shui are reflected here.

The location of the Old Street is the source of urban development in Fenghuang Town. It is backed by Yingpan Hill and Zhongnan Mountain Range, facing the surrounding rivers, forming an ideal "Beishanwangshui"(back to the mountains and looking at the water)(背山望水) pattern in Feng Shui theory.

Get to the Point

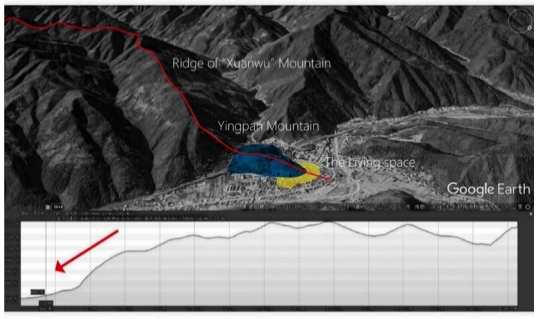


Fig. 35 Diagram of “Tortoise lower its head”[19]

"Xue" is a place where vitality gathers. The purpose of "acupoint" is to find this place. The shape of the "Xue" in Fenghuang Town is the "Ru Xue"(乳穴) in Fengshui theory, which is Yingpan Mountain. "Zang Shu"(Burial Book)(葬书) says: "Xuanwu lower its head, Zhuque flying, Qinglong winding, Baihu tamed." "Xuanwu lower its head" refers to Yingpan Mountain where the trend of "Xuanwu Mountain" is gradually falling. People in Fenghuang Town regard Yingpan Hill as a "Xue" as their “Ying Zhai”(cemetery)(阴宅), which is a tribute to the deceased, while the plain part under the Yingpan Hill as a "Mingtang"(明堂) is the “Yang Zhai”(living’s house)(阳宅).

Selecting Direction

The town of Fenghuang was built in the Tang Dynasty, and "Get to the Point" of the Town was influenced to some extent by the capital of the Tang Dynasty, Chang'an (now called Xi'an)(长安). From

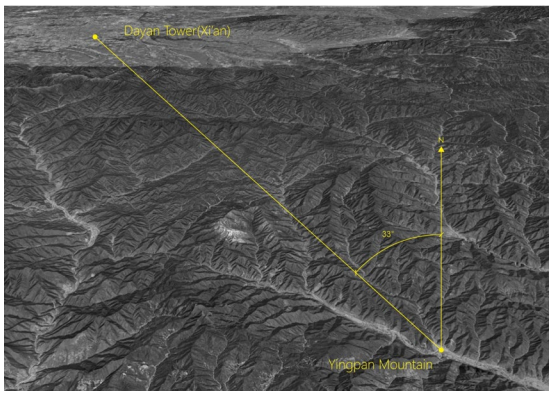


Fig. 36, we can find that Chang'an is located 27 ° north-west of Fenghuang Town.

For "Yin Zhai", people tend to place more tombstones on the north and west sides of Yingpan Hill, while there are only few in the east; for "Yang Zhai", the overall trend of the Old Streets in the ancient town is perpendicular to Its connection with Chang'an means that people are more willing to orient their houses towards the capital. People hope to get good fortune from the capital in this way.

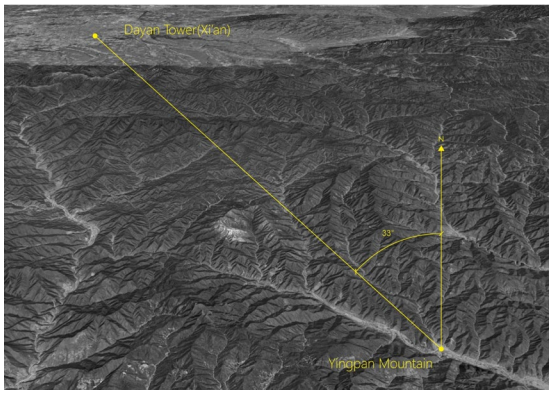


Fig. 36 Relationship between Fenghuang Town and Xi'an[19]

Fig. 37 Direction impact from Xi'an[19]

2.2.2 Nature structure of the Town

Greenery structure

Fenghuang Town belongs to the fourth level in the Chinese administrative system, that is, the Township-Level administrative area, the smallest level, rural city. These kinds of city have been based on agriculture since ancient times. Although Fenghuang Town had a certain commercial and trade function in the Tang Dynasty, its ecological environment was still dominated by agriculture and forestry. The greenery structure of the plain of Fenghuang Town is dominated by planting agriculture, and the greening structure of the surrounding mountains is

dominated by naturally growing forests.[28]

The agriculture in the town is dominated by food crops, wheat in summer, and corn and sweet potatoes in autumn. Residents' private crops are mainly based on common vegetables and fruits for themselves.[28]

The forestry in the town is mainly divided into two types: shelter forest and timber forest. The shelter forests are mostly poplar, walnut, and Cyclobalanopsis glauca, and the talented forests mainly include Betula, Ailanthus altissima, fir trees, pine trees, and cypress trees.[28]

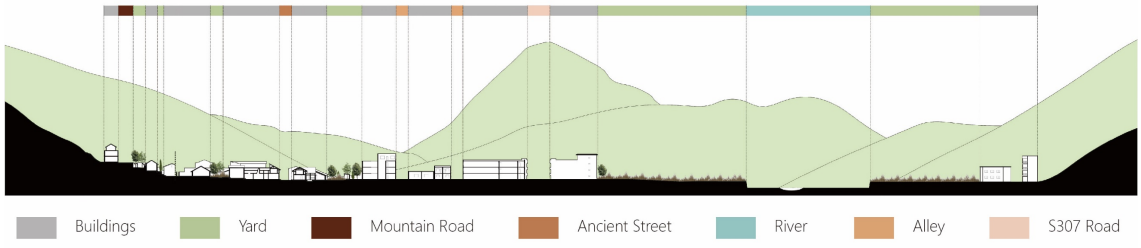


Fig. 38 Section of the Green system[25]

Fig. 39 Private garden

Fig. 40 Public garden

Fig. 41 Farmland

Fig. 42 Cemetery

Fig. 43 Piazza

Fig. 44 Piazza

[25] Developed by the 2018 Fenghuang Workshop. (the Author included)

Fig. 45 Mapping of the greenery structure of Fenghuang Town[25]

Water structure

The structure of the river system in Fenghuang Town has been described above, and it includes three natural rivers, which is Shechuan River(社川河), Zaohegou River(皂河沟) and Shuidigou River(水滴沟), and an artificial canal. The domestic water in the town comes from the municipal water supply, the drainage system in the town is the ditch from ancient times, and it is finally discharged into the municipal sewage pipe.[29]

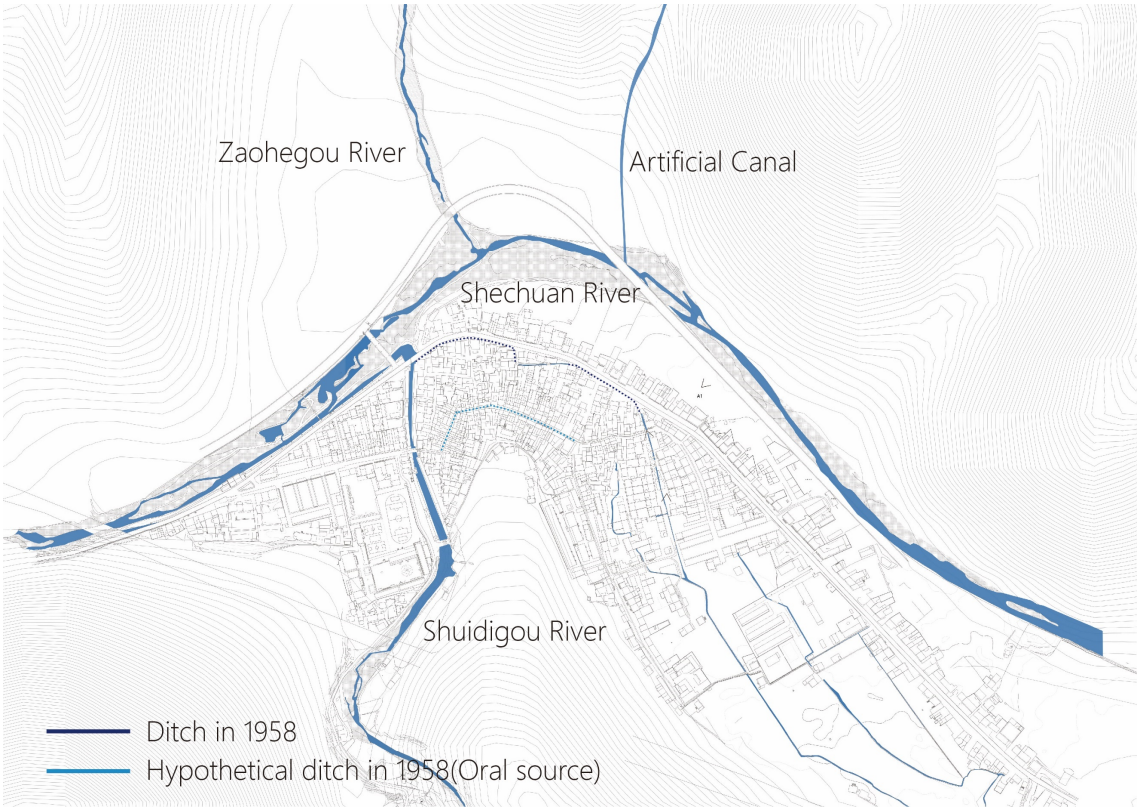


Fig. 46 The Water Structure of Fenghuang Town[25]

Fig. 47 Shechuan River

Fig. 48 Zaohegou River

Fig. 49 Shuidigou River

Fig. 50 Ditch in town

2.2.3 Space structure of the Town

Morphological structure

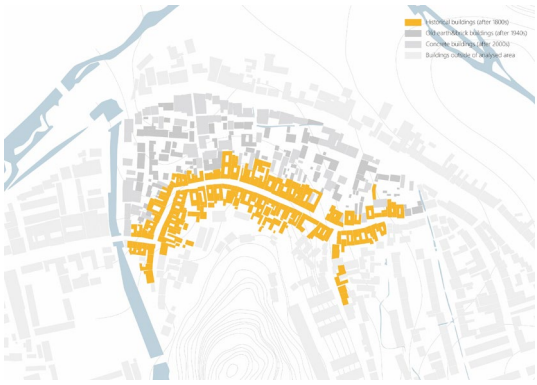


Fig. 51 Fish-bone morphological pattern of Old Street

The result of the site selection of Fenghuang Town comes from the traditional Chinese Feng Shui theory. As the core area of the ancient town, Old Street has formed a Fish-bone morphological pattern during the period of its establishment. By drawing the mapping of today's historical buildings, its morphological characteristics can still be found.

Through literature review and survey, colleagues of the Fenghuang Workshop of XAUAT & POLIMI and author collected image data about the ancient town in different periods,

including hand-painted panoramas in 1957, panoramic photo in 1958, satellite maps in 1966 [26], 2006 Schematic diagram of masterplan, the Google satellite image in 2013 and the Google satellite image in 2018. This article looks for the growth logic of ancient towns by analyzing these sgeographic images.

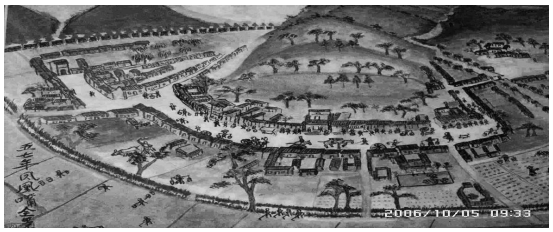


Fig. 52 Hand-painted panorama in 1957[21]

Fig. 53 Panoramic photo in 1958[27]

Fig. 54 Satellite maps in 1966[28]

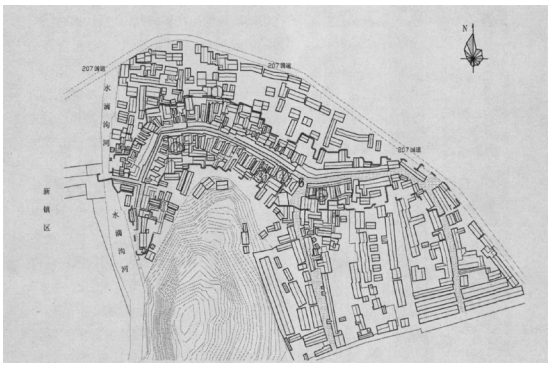


Fig. 55 2006 Schematic diagram of masterplan[30]

Fig. 56 Google satellite image in 2013[19]

Fig. 57 Google satellite image in 2018[19]

Before the founding of the People's Republic of China in 1949, there were

[26] Sources: https://earthexplorer.usgs.gov
[27] Fenghuang Old Town Tourist Development and Construction Management Committee, 2012
[28] https://earthexplorer.usgs.gov/

mainly Fish-bone shaped houses on the Old Streets in Fenghuang Town. The urban form has maintained a steady and slow development during this time. After that period, the ancient town has undergone certain construction and development, and its morphological characteristics of the ancient town. In addition to the architectural form, the major change is the form of fields. Strips of farmland run through all the villages in the valley, including Fenghuang Town. This structural feature is consistent

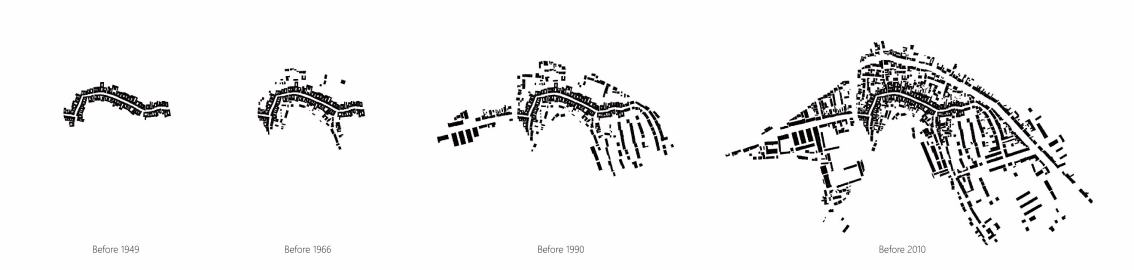


Fig. 58 The diachronic mapping of transformation of Fenghuang Town[25]

Fig. 59 Morphological characteristics of fields and buildings in 2013[29]

urban texture continues to change the with the architecture in the ancient

[29] After reading the Book getting lecture of Prof. Laura Pezzetti, author start understanding the radial strip structure of the Fenghuang Town, both buildings and fields. The diagram is drawn based on the it.

town and is reflected in its scale and form.

The legend of Phoenix Wing shape of the ancient town comes from the oral interview, but its form undeniably has the characteristics of radial fan-shape. Through Yingpan Hill, the buildings at the farmland between the Old Street and Shechuan River shows the urban form that presents a distinct radial fan-shape level, which is also composed of countless strips.[29]

Fig. 60 Radial fan-shape of the Town[29]

2.2.4 Living structure of the Town

Function asset

The functions of the ancient town mainly include 13 types:

Residential, religion, retailing, manufacture, restaurant, facilities, clinic & pharmacy, entertainment, hotel, commercial, education, administrative office and abandoned.

The ancient town takes the residential

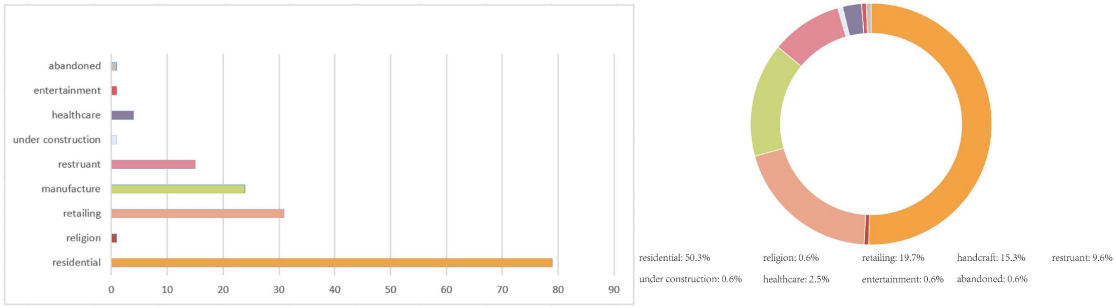


Fig. 61 Ancient street function proportion analysis[25]

Fig. 62 Old residential

Fig. 63 New residential

Fig. 64 Retailing

Fig. 65 Restaurant

Fig. 66 Education

Fig. 67 Religion

Fig. 68 Manufacture

Fig. 69 Abandoned

as the main function, and at the same time has a large proportion of the commercial, its function revolves around the relevant culture of the ancient town.

The research helps to understand the needs of the ancient town through SWOT analysis of the related functions of the ancient town.

Strength:

1. The proportion of handwork is large, which is conducive to attracting tourists;

2. The original appearance of small towns has been maintained, and the proportion of residence is large;

3. The residence is linear and has strong continuity.

Weakness:

1. Less cultural and total buildings, difficult to support public events;

2. Lack of commercial activity at the end of Old Street.

Opportunities:

1. Some houses are under construction to keep the town alive;

Fig. 70 Mapping of function asset[25]

2. Some buildings have strong design and protection potential.

Threats:

1. Some houses were abandoned due to poor quality and were not protected;

2. The ancient town lacks other

functions to attract tourists to live for a long time.

Existing Relevance

The existing relevance in the ancient town mainly include 5 aspects: cultural, entertainment, commercial, tradional craft and fields. They have an important influence on family structure, occupation, income source, and income level. The study conducted social and economic surveys on these aspects. Research has mapping the existing relevance, including:

Retail store, restaurant, clinic & pharmacy, market, hotel, education, museum, religion, entertainment, cemetery.

Fig. 71 Mapping type of existing relevance[25]

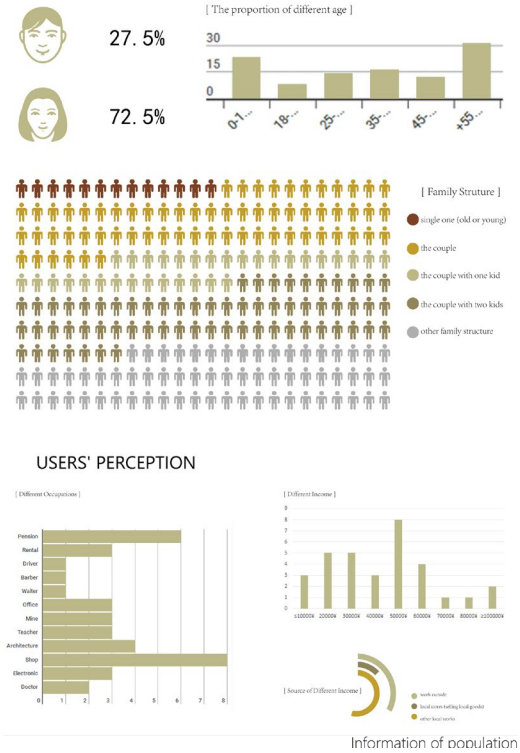


Fig. 72 Economical aspects[25]

Fig. 73 Pictures of different occupation

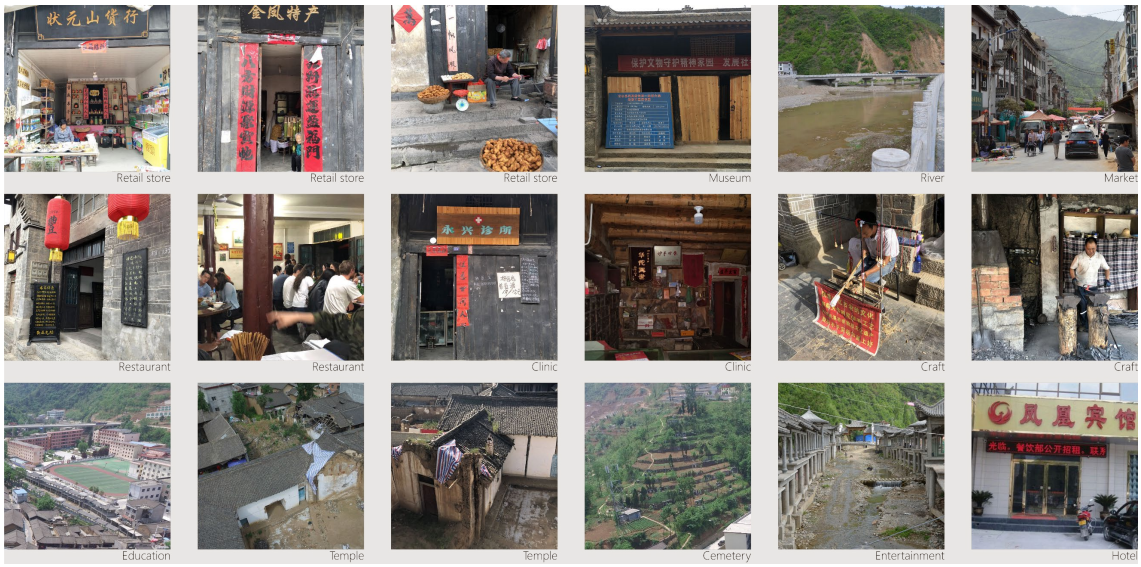


Fig. 74 Pictures of the existing relevance

Fig. 75 Mapping of existing relevance[25]

User's need

For the needs of the residents of the ancient town, the most important

thing is the rational use of resources, including the reuse of traditional houses and the rational use of natural resources:

The traditional dwellings:

1. Keep the traditional typology;
2. Keep the traditional culture;
3. Repairing the destroyed area.

The nature resources:

1. Enlarge the view to landscape in different buildings;
2. Replant in the abandoned backyards;
3. Keep the forests in the mountain;
4. Reuse the main rivers in the town.

The study investigated the needs of people of different ages for space in ancient towns. The needs of young people are mainly in entertainment, sports, service facilities, and scenic spots, while the elderly have more economic, commercial, leisure, and good living conditions.

For the needs of people of different occupations, the local people need to develop the economy and infrastructure more. Tourists hope to have more tourist services, landscape shaping, scenic spots, rural experiences, etc., and the government hopes to propose a perfect development of the urban planning.

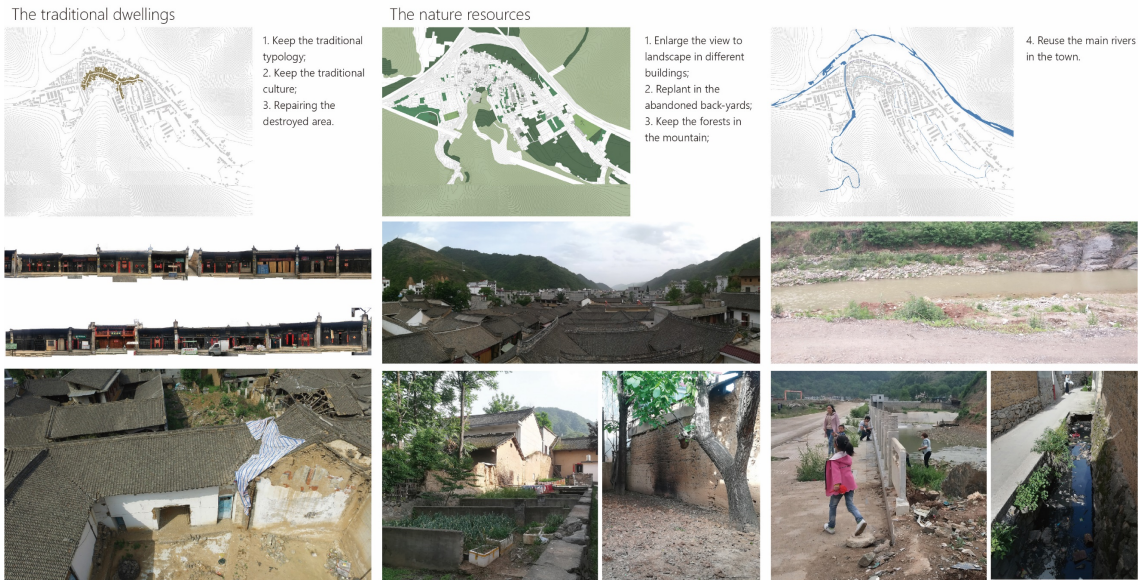


Fig. 76 The use of the resources[25]

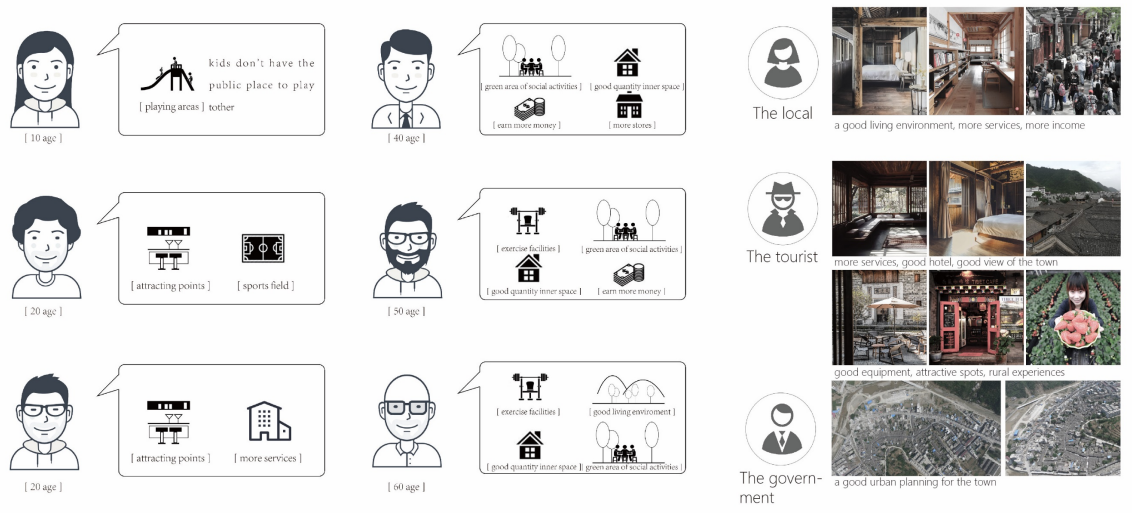


Fig. 77 The needs from different people[25]

The ancient commerical street

The ancient commercial street keeps the traditional apperance of the Fenghuang Town, which is the core of the town.

The stores sells the local goods for tourists and the local.

The local work in front part of the traditional dwelling and live in the back.

The new commercial street

The new street is the extension of the old.

There are lots of stores selling the goods for modern life needs, which is not attractive as well as the old street.

The buildings in this street are higher at least 2 floors than the ancient buildings, which have "fake" traditional facade.

Fig. 78 The living of different parts in the town[25]

Infrastructure network

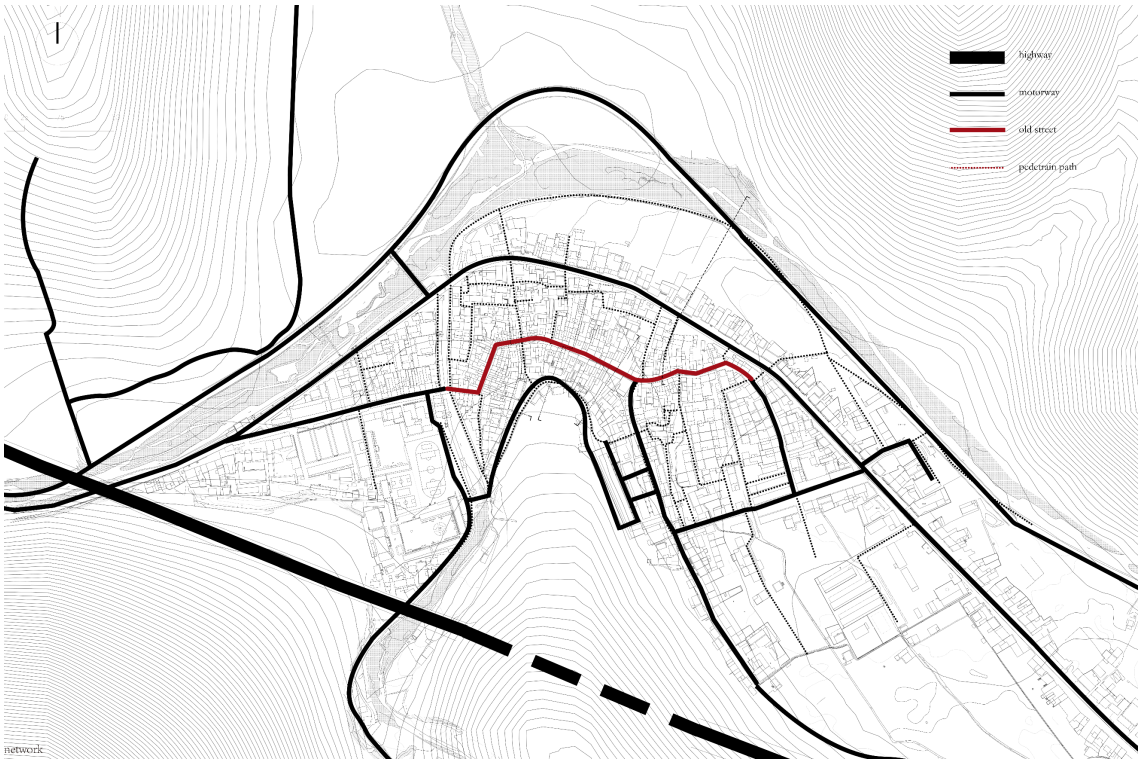


Fig. 79 The network of the town[25]

The traffic level of the ancient town is divided into 4 levels, which are highway, provincial road, the ancient street and urban trail. Highways and provincial roads are modern roads leading to Xi'an, among which

provincial roads also have certain commercial functions. The main road inside the ancient town is the ancient street, which has a history of more than 200 years and is the core of the ancient town. Urban trails mainly provide residents with basic transportation services.

2.3 The Chaos of Urban Development in Fenghuang Town

2.3.1 The loss of traditional space

Fig. 80 Concrete replacement of old block

The Old Street buildings in Fenghuang Town has maintained a traditional space with Chinese characteristics in the development history of more than 200 years. However, the development of modern industrialization has brought rapid expansion to the construction of the ancient towns. The traditional space of the town was destroyed to a certain extent. At the same time, due to the loss of population in the ancient town, it is

difficult to inherit the traditional technology. Old buildings no longer use traditional repair materials and technologies, but instead use concrete and other building materials and irreversible repair technologies.

Through the satellite map and old pictures, you can see that a large

Fig. 81 Old picture about Fenghuang Town in 1958[27]

Fig. 82 Google Map in 2018[19]

number of "concrete blocks" have appeared inside the ancient town, and even in the protected area of the Old Street, the phenomenon of "concrete blocks" replacing the original historical buildings.

The loss of traditional space is mainly reflected in the protected area of the Old Street. Since China has experienced a special period against feudal superstition, people's belief in religious sacrifice is much less than before. The main body of the Erlang Temple has now collapsed, and its monumental space is no longer used by people.

Fig. 83 The main room of the Erlang Temple(disappeared)

Fig. 84 The kitchen of the Erlang Temple

There is also a certain loss of the characteristic space of traditional houses. In order to obtain a larger living space, some residents occupy as many narrow courtyards as possible in order to expand the use area. At the same time, due to the industrial transformation of the ancient town, more and more people are no longer farming, and the planting function of the backyard space is also lost.

Fig. 85 Occupation of courtyard

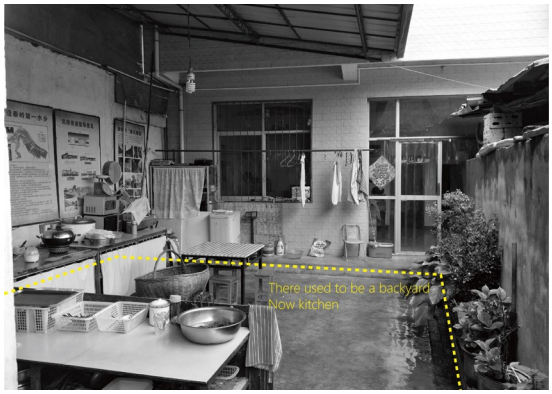


Fig. 86 Occupation of backyard

2.3.2 Disordered new construction

Fig. 87 A example of dense construction

The new construction and urban planning of new buildings in the ancient town were not managed in the early days. The locals built many concrete houses along the new street, and did not continue the construction texture of the Old Street. In their cognition, the higher the house built, the more imposing it is. To a certain extent, this has caused a large number of new buildings to be built too densely, sacrificing the original landscape quality of the village, and also made the old buildings oppressed. The original growth mode of the ancient town is a fishbone development model. As the center of the city, the Old Street develops horizontally perpendicular to the Old Street and produces "strips". The

Fig. 88 Diagram of the structure of the Town and the fields (Following the 2008 Google Map)[29]

growth form of the ancient town is similar to radial fan-shape. "*The trangle formed by the plateau of the Yingpan Hill and the radial lines of the structure, the 'fan' of the fields, the figure of the Phoenix's wings in the Old Street, the 'strips' of the strigatio, the shape of the river.*".[9]207 But due to disordered new construction, the shapes of fan and strips are gradually disappearing.

The destruction of nature by the new construction is also enormous. The Wuguibao Hill and Yingpan Hill in Fenghuang Town were destroyed by the construction of the highway; the Shechuan River gradually dried up due to the construction of the expressway; the strips of farmland along the river were destroyed and used as paving squares. All these operations have had a devastating effect on Feng Shui in Fenghuang Town.

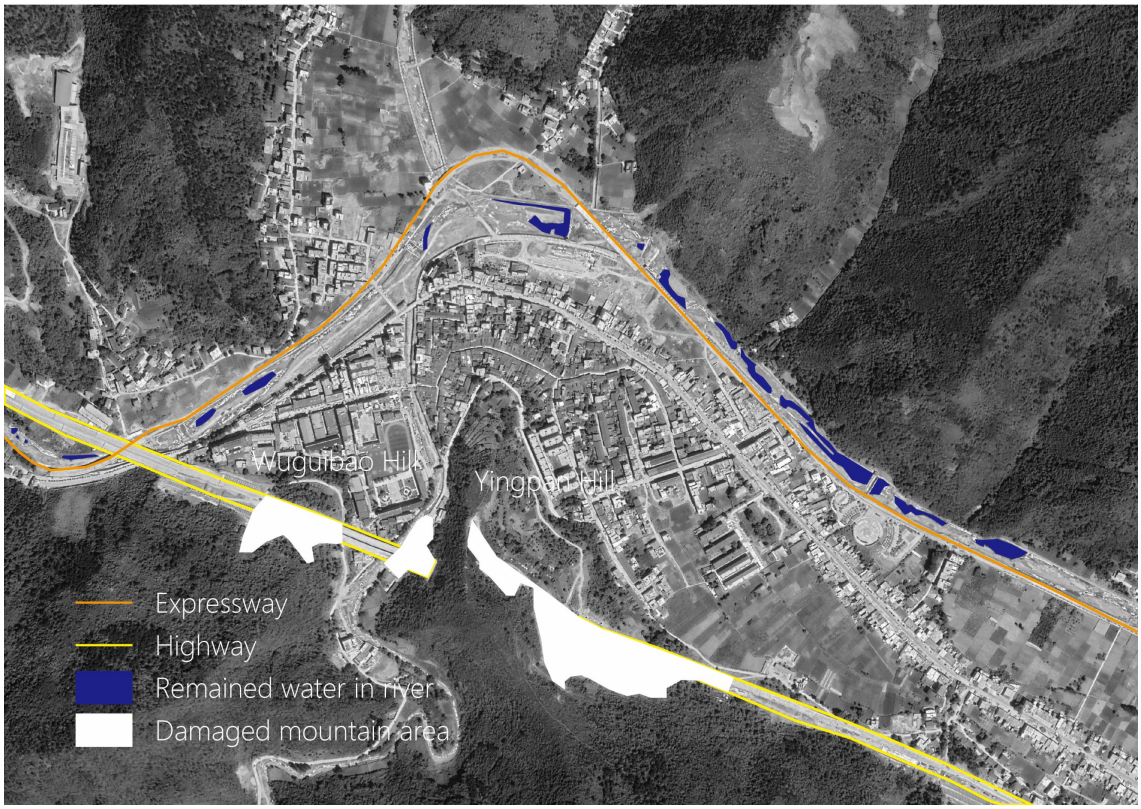


Fig. 89 Devastation of the environment caused by the new construction[19]

2.3.3 The gap between the Old and New

Through research and analysis, the main contradiction of the ancient town space comes from the gap between the Old and New. The space of the Old

is abandoned, and it has not been traditionally restored and used. The space construction of the New does not continue the growth logic of the ancient town and to a large extent destroys the original texture of the ancient town.

There are several main sources of the gap after analyzing:

1. The traditional activities are lost gradually;
2. The population loss is very serious;
3. Religion Space is abandoned for a long time, and people have forgotten the God of Land and Sky because they don't need to farm anymore;
4. The traditional crafts are lost gradually, and it is very difficult to succeed the skills about dealing with wood structure from the old craftsman;
5. The government didn't attach enough significances on the conservation, either digging its value;

The Town is constantly evolving, and it is incorrect for people to completely abandon the New and build a fake old building. How to coordinate the relationship between the New and the Old has become the main content of the article. In the next chapter, the range of the study is reduced to the area between Old Street and New Street. The study will achieve the purpose of Continuing the historical traces of the ancient town by solving the contradiction between the New and the Old.

Chapter III General Urban Strategy Between the Old and New Space

3.1 Palimpsest of In-Between Space

3.1.1 The research scopes

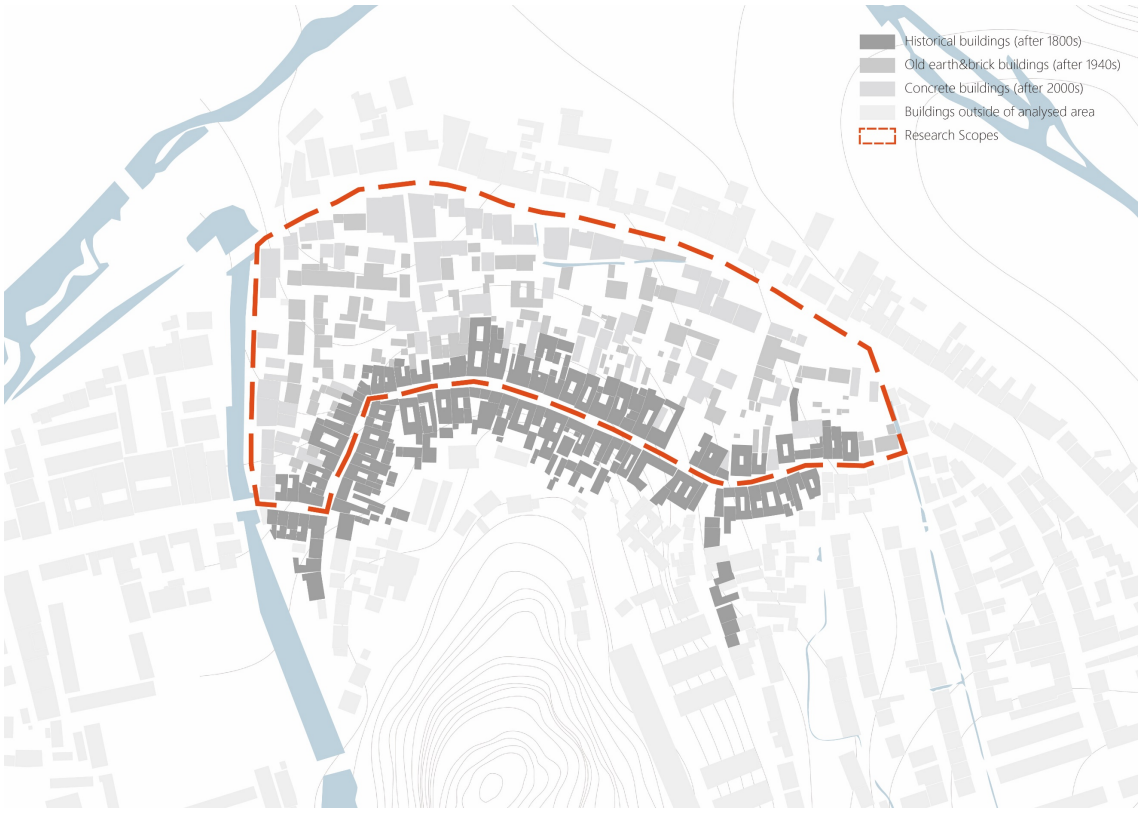


Fig. 90 The research scopes

This article focuses on the research scopes between the Old and the New areas, and defined it In-Between Space. It has the characteristics of urban radial fan-shape and strip, but due to the irrational construction of concrete blocks, its morphological characteristics have been destroyed

seriously. This has caused the fragmentation of public space here, The Old Street exists as the core of the ancient town; however, the New Street is newly built for transportation needs between provincial levels. New buildings on the New Street are in a messy state because they have not been unified to planning. The municipality adopts "Fake Antique" style facade decoration that looks like an old street in order to unify the new construction. This practice has destroyed the cultural value of the ancient town, and at the same time the conflict between the Old Street and the New Street has intensified.

and the continuity has been lost.

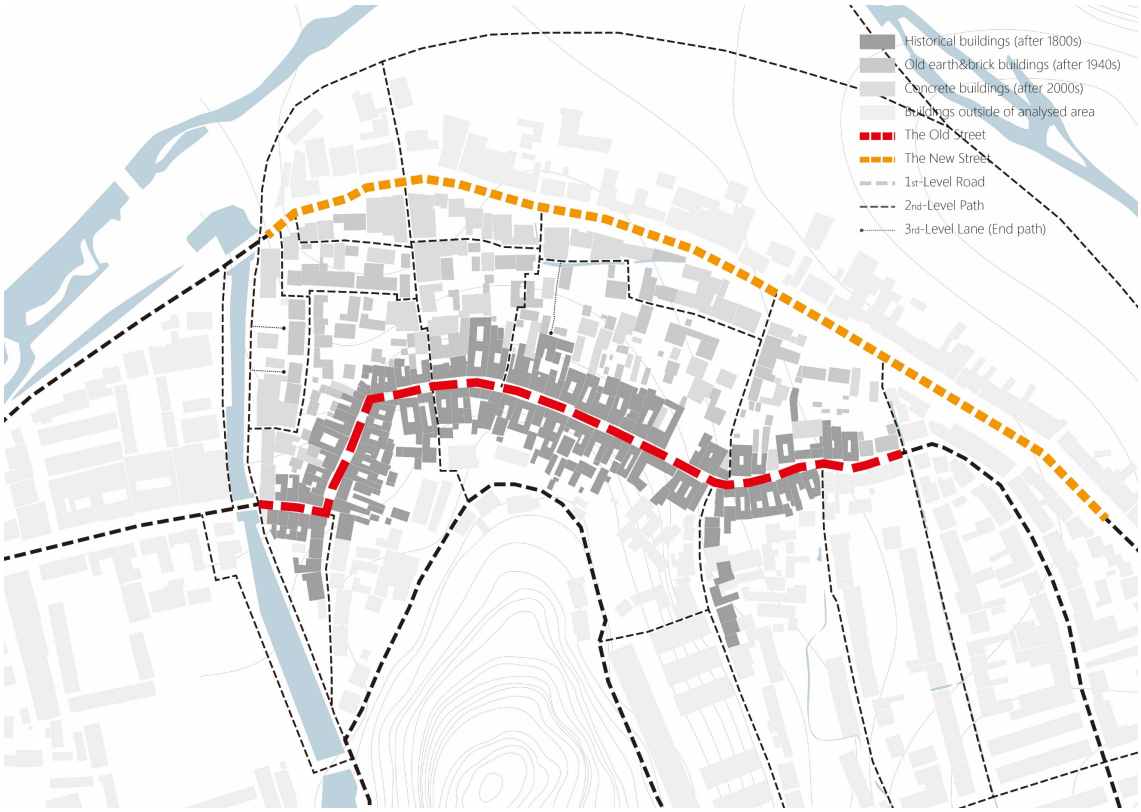


Fig. 91 The relationship between the Old Street and the New Street

3.1.2 The Influence of Land Distribution System on the Formation of Spatial Structure

According to China's land distribution system, if the number of villagers in a household exceeds the housing capacity, the municipal department

can allocate new land to the descendants of this household to build new houses. However, due to the inadequate supervision, a large number of houses were expanded and added on the homestead by occupying the backyard or courtyard. The size of these concrete blocks is too large to destroy the original urban texture of the town. This led to a state of chaos in the In-Between Space.

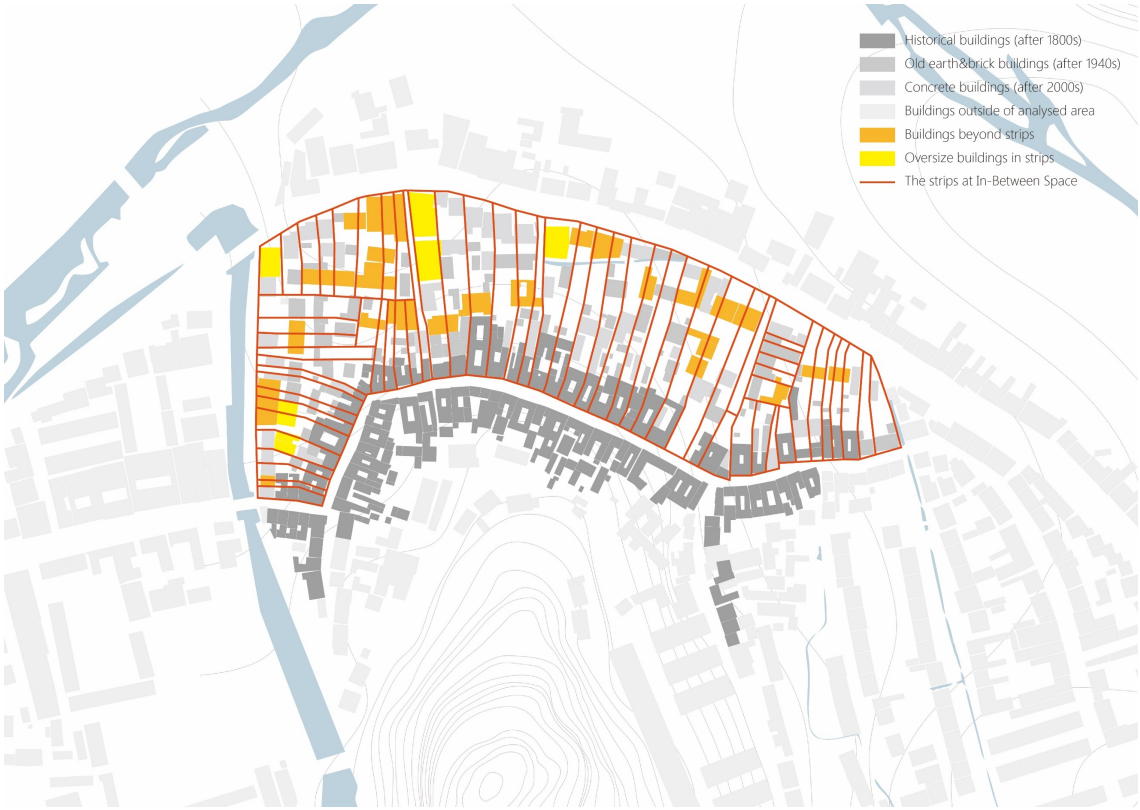


Fig. 92 The Strips of In-Between Space[29]

3.1.3 Morphological characteristics

By categorizing the morphological characteristics of the Fenghuang Town, this article will analyze the contradiction of In-Between Space. There are two types of morphological types in ancient towns: units and groups, and units are part of the group. Different groups form different spatial patterns, and there are only some following the growth characteristics of the ancient town's strip logic. This article explores the combined relationship between the old wood & earth block with sloped roof and the new concrete block with flat roof for the next step of Rewriting.

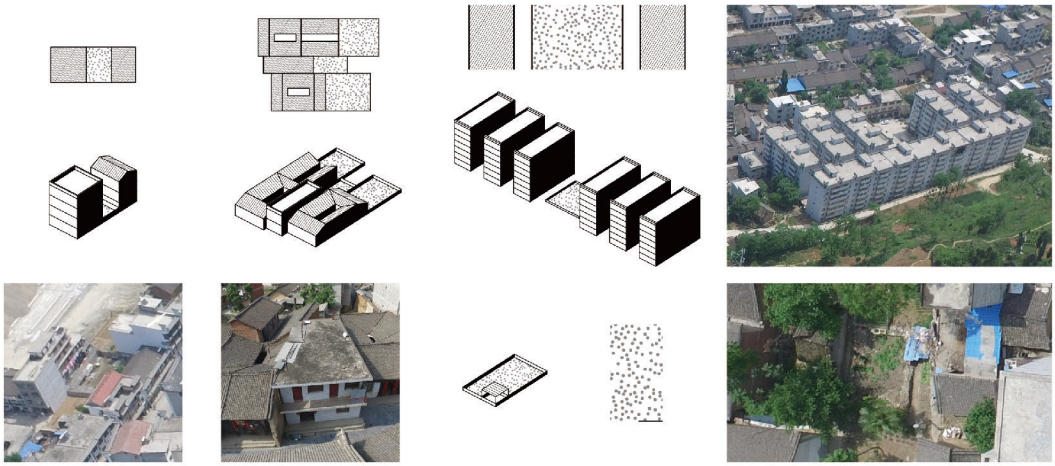


Fig. 93 Morphological characteristics of the Town

3.1.4 The issues of In-Between Space

There are two most important issues at In-Between Space, the fragmented public space and the complex undirected end paths.

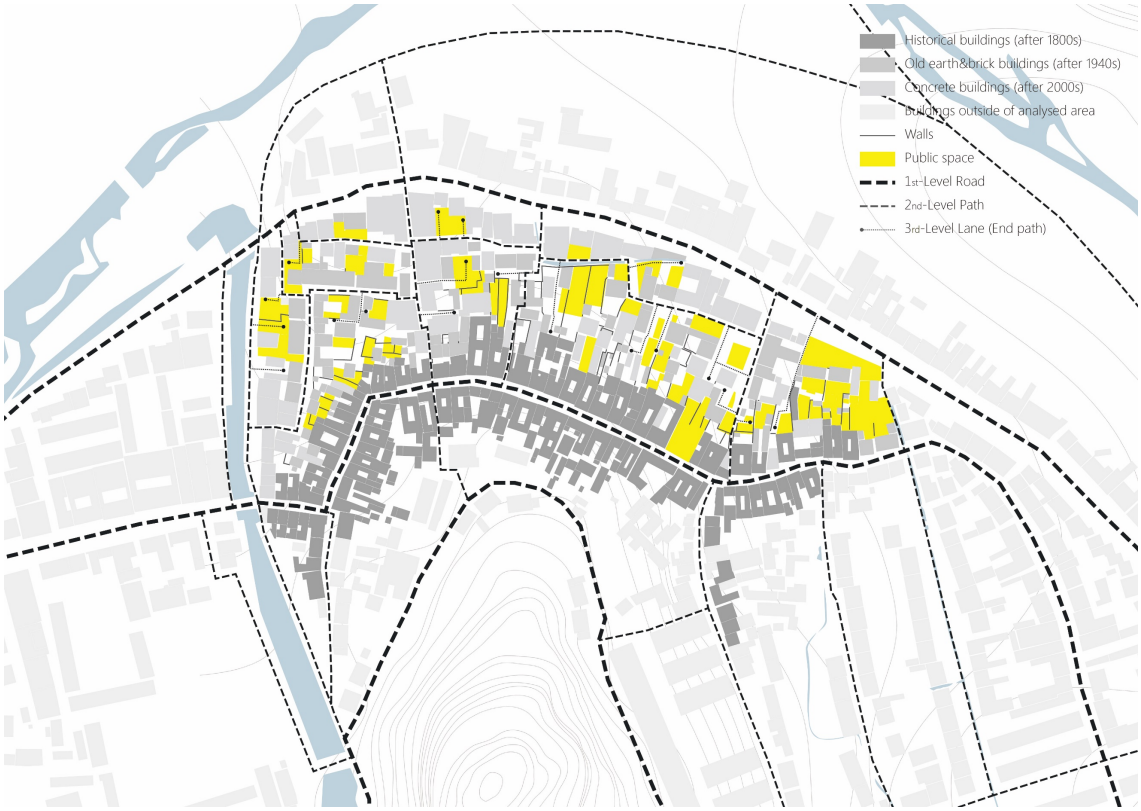


Fig. 94 The space issues of In-Between Space

The main users in this area are residents. Due to population loss and the construction of an elementary and middle school in the ancient town, most of the houses here were rented to women with children in nearby villages. The male is responsible for working outside to support family expenditures. Most of the female do not have jobs and can only earn a meager income by manual work, and a large part of their food comes from vegetables and fruits grown in public farmland. Children lack a public activity space in this living area and can only play in the playground of school.

For tourists, they will occasionally walk outside the ancient street. Once their desire to explore rises and enter the In-Between Space, they will feel frustrated by what they see in front of them. There are many trails connecting the Old Street to the New Street, but the space does not have rich commercial atmosphere and beautiful ancient buildings, compared with the Old Street.

3.2 Strategy of Continuity

For the issues of In-Between Space, on the condition of keeping the morphological characteristics of the ancient town, the radial fan-shape and strip, the author attempts to adopt the strategy of continuity, which is to fix the structure of the strips and to connect all the fragmented public spaces.

First, the design includes recombining the wall of strips, and demolishing some houses that affect the urban structure. Then, the design connects the existing fragmented public spaces from west to east through some paths and making some holes on the walls. The research conducted statistics on the width of strips of In-Between Space and calculated its average width to be 8.335m. The design will use the basic scale of 8m to mesh the In-Between Space and incorporate 7 functions, according to the interview of needs of the local, retailing, playground, bar, homestay, cultural service, agricultural experience field and leisure spot. Through calculation and empirical analysis of the area size and service capacity required for these 7 functions, the author uses 8m as the grid base to formulate 4 scale grids, 16m, 32m, 48m and 144m. Then based

on the existing public space to interfere gets the final function layer.

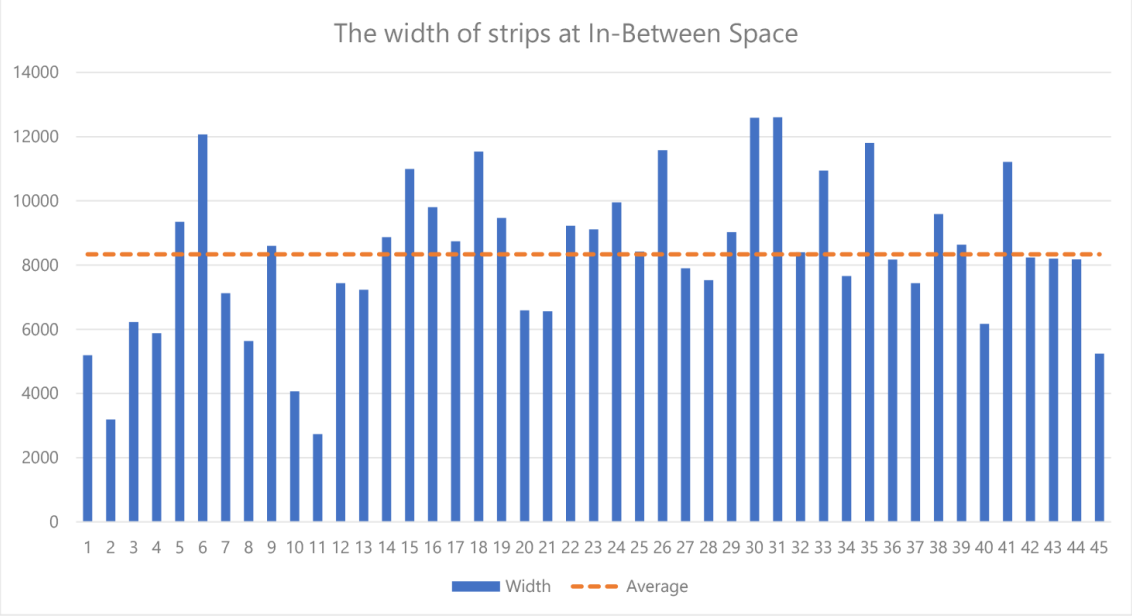


Fig. 95 The statistics of the width of strips at In-Between Space

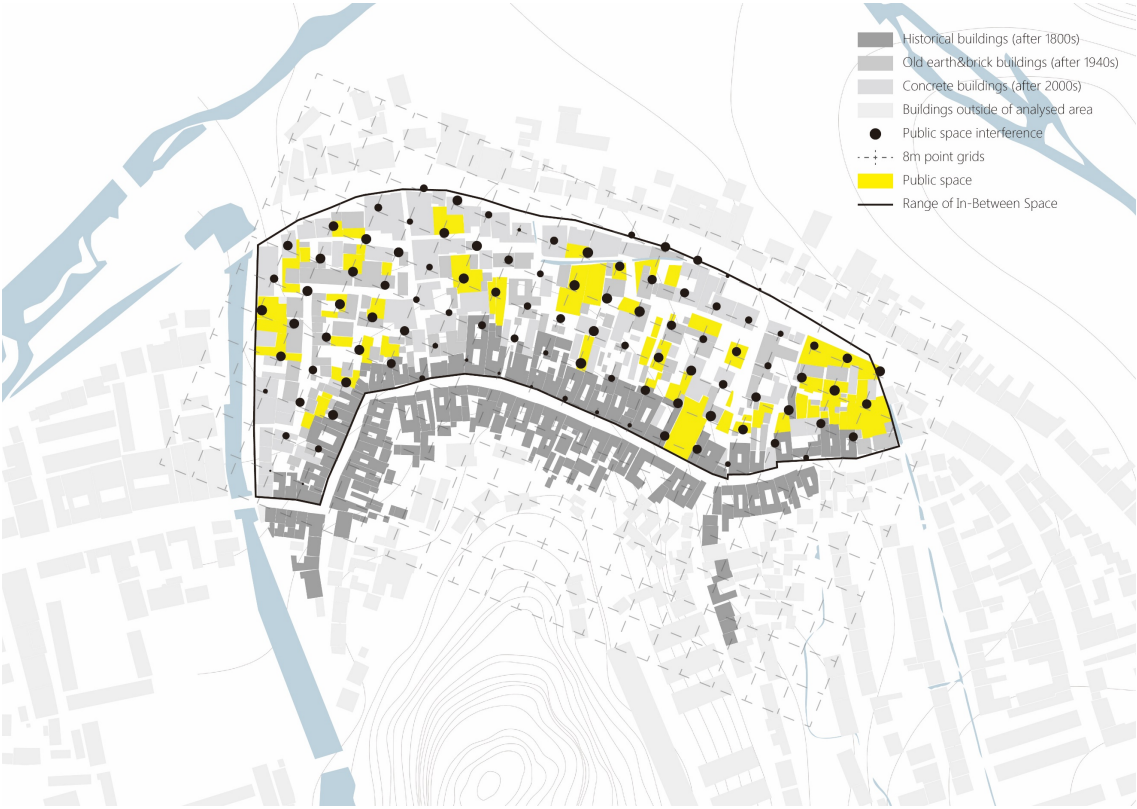


Fig. 96 The result of public space interference

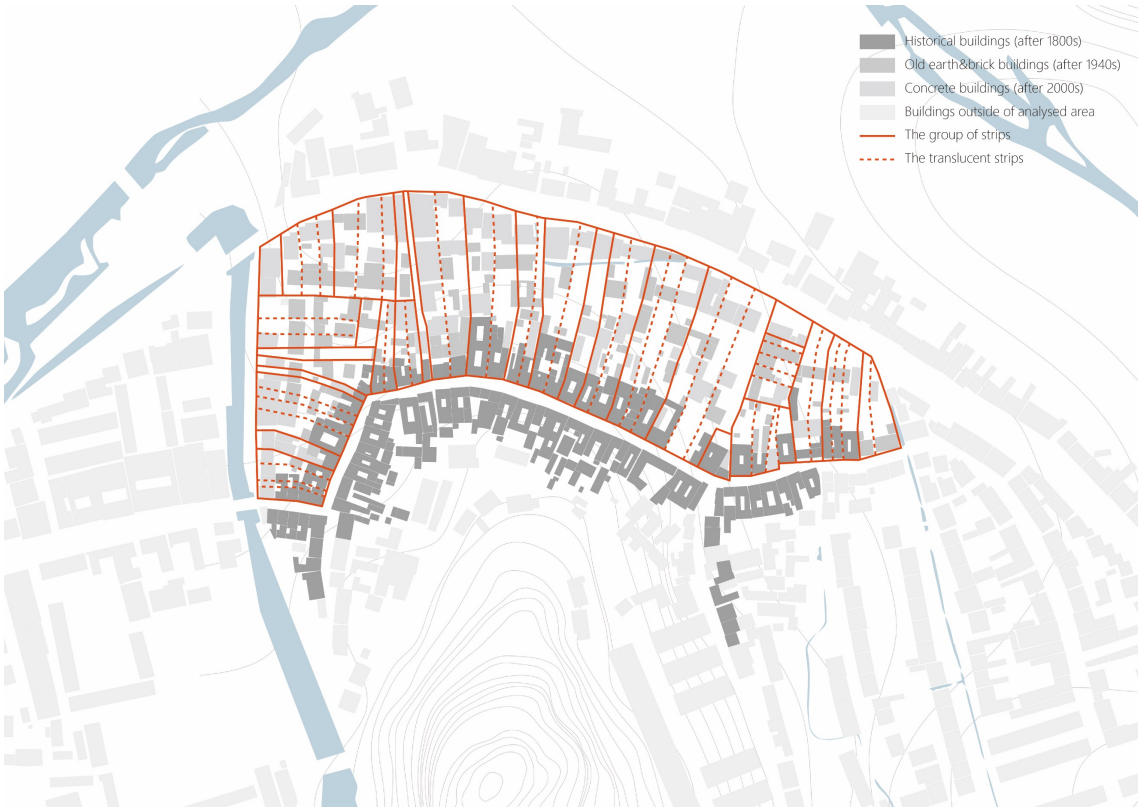


Fig. 97 Strategy of the groups of strips[29]

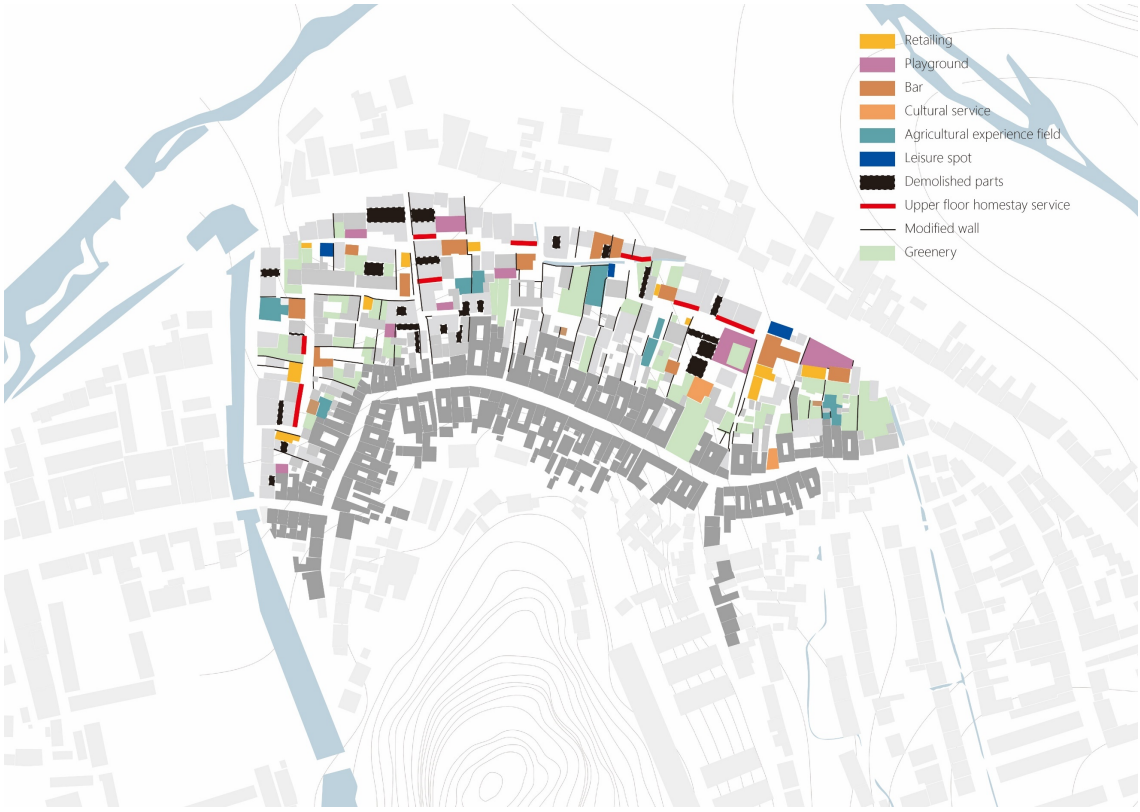


Fig. 98 The final layer of function insertion

3.3 Rewriting the Cultural Axis

3.3.1 Strategy of cultural axis

The most important historical resource of Fenghuang Town is the Old Street, which attracts tourists with its cultural characteristics. However, the Erlang Temple, the ancient religious site of this town, has been abandoned for many years. The restoration of the Erlang Temple is indispensable, and the design should guide people to recognize the religious culture of ancient Chinese people and maintain awe of it.

To the northeast of the town is a mountain called Yangpo. The reason why the mountain is named Yangpo is because people living in the town see the sun rising from this mountain every day. By drawing the masterplan, the author found that there is a certain connection between the top of Yingpan Hill, Erlang Temple and Yangpo Mountain, which is, on a straight line.

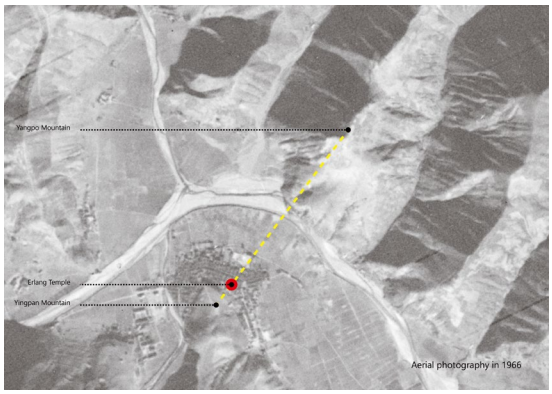


Fig. 99 The relationship between the temple and mountains[28]

Fig. 100 Expand the cultural axis[19]

The Yangpo Mountain, where sun rise from, represents the new life birth, the Yingpan Hill, where the cemetery is, represents the death, and the Erlang Temple in the middle is the dwelling that people built for the God who protect them, the Erlang God. Legend says that the Erlang God can remediate floods, promote farming, and surrender devils and demons, so

many towns have this kind of temples with the same name.

The house on the Old Street and directly opposite the Erlang Temple was destroyed by a fire in 2018. The design attempted to extend the axis of the Erlang Temple and expand the cultural atmosphere of the ancient town. The author finally determined the design scope. The area includes Erlang Temple, lacuna space and a part of the concrete block. This area is also part of the In-Between Space, the meaning of this intersection place will be explained in the architectural design.

Fig. 101 The relationship between Cultural axis and In-Between Space axis

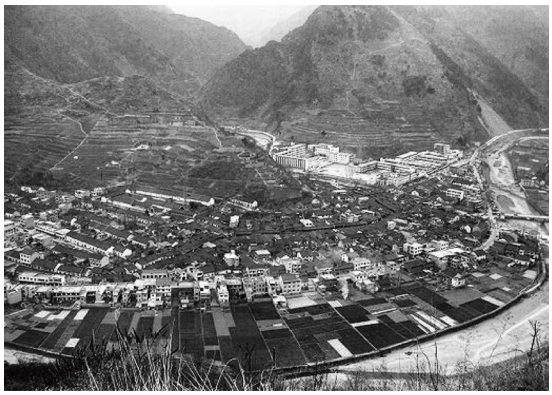


Fig. 102 ①View from Yangpo Mountain[30]

Fig. 103 ②Urban texture of the town at now

Fig. 104 ③Falling of the Temple

Fig. 105 ④Falling of the Temple

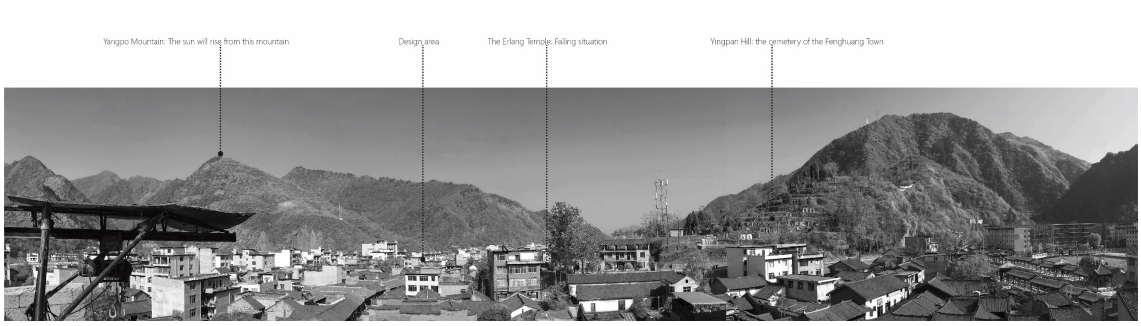


Fig. 106 ⑤View from a high building in west of the town

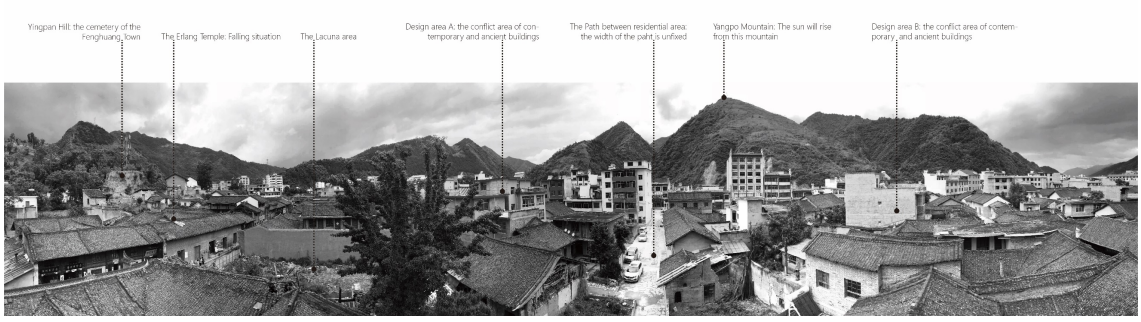


Fig. 107 ⑥View from a high building in middle of the town

[30] http://baike.youabc.cn/k_10969192.html

Chapter IV Architecture Design at Cultural Axis Area

4.1 Rewriting the Erlang Temple, Lacuna Area and Fragment

4.1.1 Current situation & whole design

The project area is arranged for its special meaning. First, the Erlang Temple was the core traditional house of the Town. Then, the Lacuna and the Fragment is destroyed by a fire in 2018, we can see the potential of this area. Last, the Modern Generic Buildings in In-Between Space is an important component of New Cultural Axis. For these reasons, the author starts to analyze the project area, including plan, materials, functions, floors and greenery.

Materials

About the materials, in the Old Street part, traditional *Zhaiyuan* buildings mostly consist of Adobe & rammed earth *matouqiang*, wooden columns-beams structure and black tile sloop roof. Local people use the easily accessible materials from mountain and their lands, and the buildings need to be renovated after a short interval due to the corrosion of materials

For the generic modern buildings, they are composed of concrete block, reinforced concrete, red brick and so on. From the ecological aspect, these buildings cause bad effects to the Fenghuang Town, not to mention how hard to renovate and reinforce them.

Function

About the functions, there are 3 main function modes in the Town, which include commercial infront residential behind, commercial downstairs residential upstairs and mono-residential. In the Old Street, most of the buildings belong to the mode of commercial infront residential behind, in the In-Between Space most mono-residential and in the New Street, most commercial downstairs residential upstairs.

Floors

About the floors, in the Old Street, the type of the ancient building is always one floor with loft-store space, which could be kept with some farm tools and living tools. For the generic modern buildings, people are willing to built them to a taller level, like an urban fabric which could reach 4-7 floors, so that they could have more space for their next generation and renting.

Greenery

About the greenery, there are 4 morphotypes in the Town, courtyard, backyard, farmland and greenery. The courtyard is the capital space in the ancient building which is also called *zhaiyuan*, it is in the middle of the ancient building. The backyard serves as a private farmland for ancient buildings. So, the courtyard, backyard and the ancient build consist a unit of the type in the Town.

The farmland mainly refers to the public farmland in the Town, different people could use it with potential rules.

The greenery mainly refers to unattended garden

Fig. 108 Different materials in project area

Fig. 109 Different function in project area

Fig. 110 Different height in project area

Fig. 111 Different type of greenery in project area

Fig. 112 Demolished & designed of ground floor in In-Between Space

Fig. 113 Plan of the state of the art

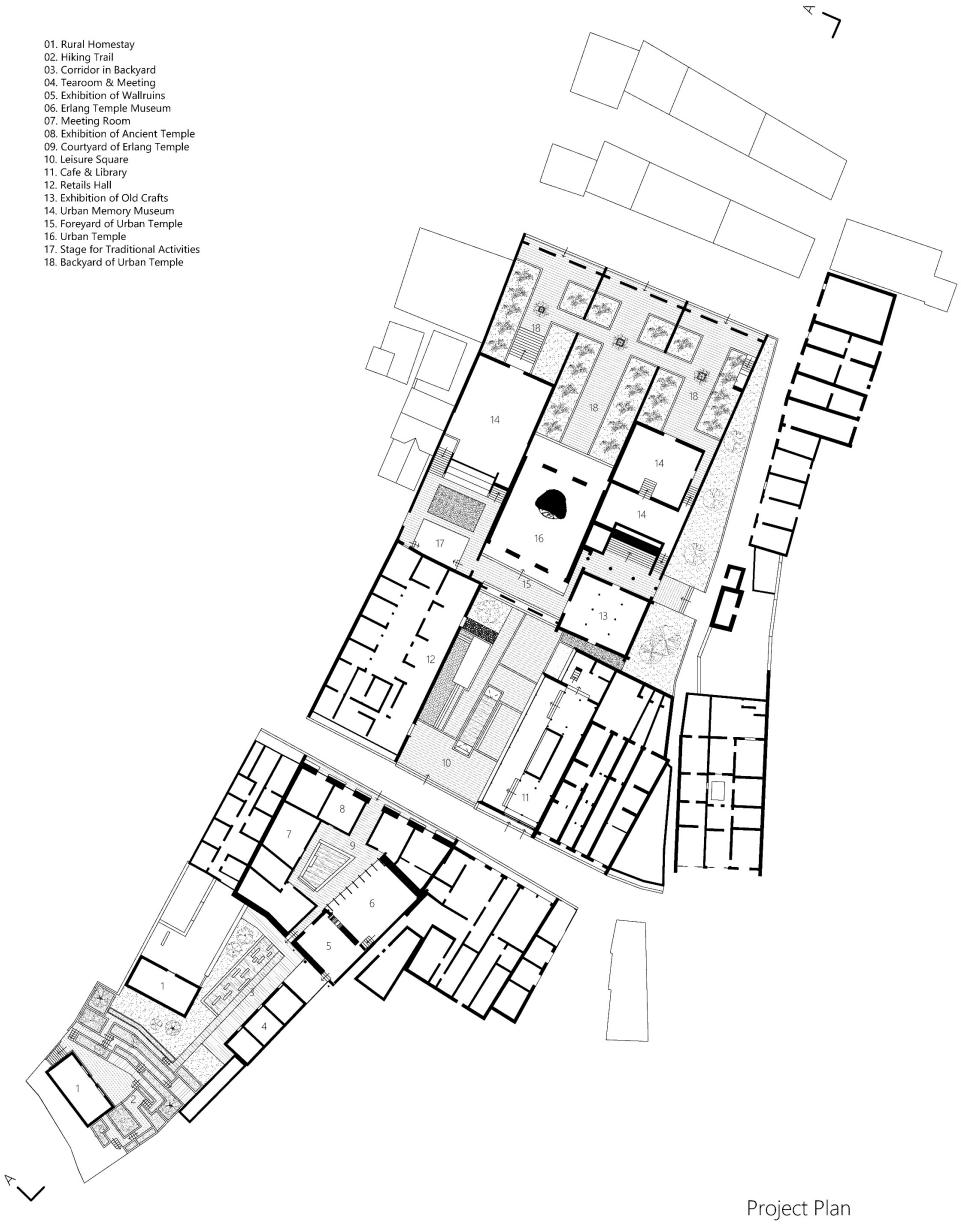


Fig. 114 Plan of the design

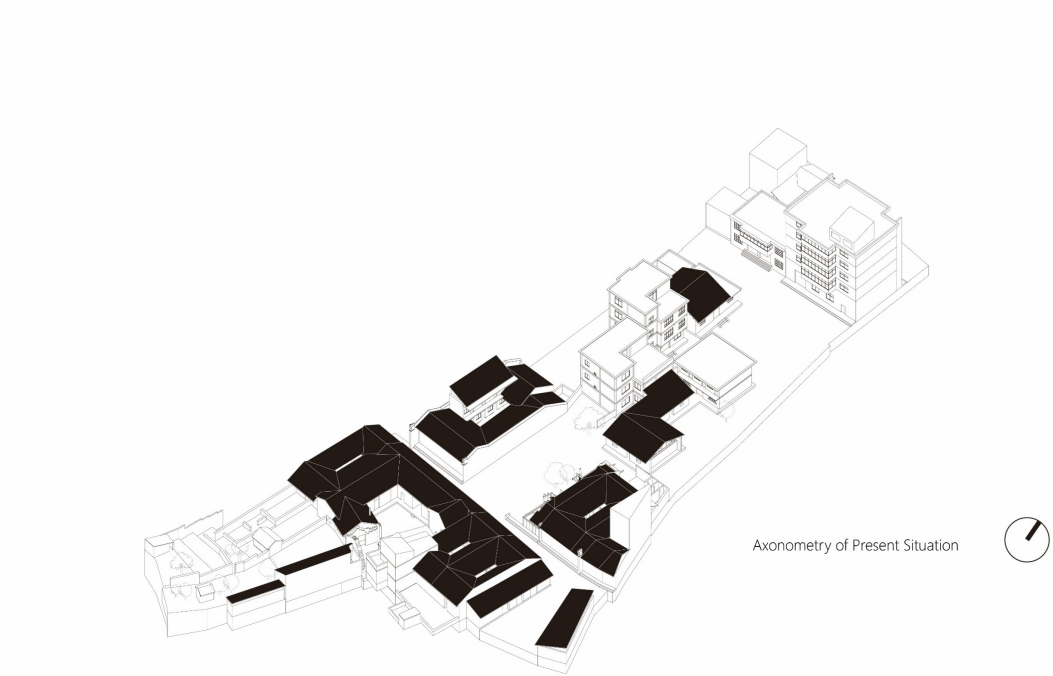


Fig. 115 Axonometry of the state of the art in project area

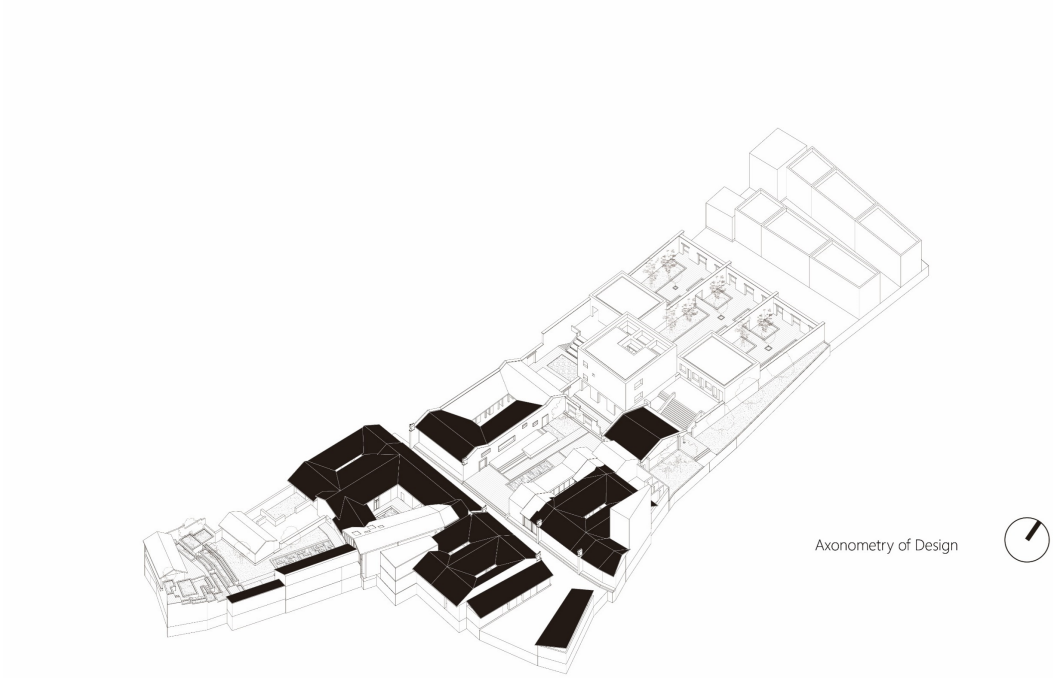


Fig. 116 Axonometry of the design in project area

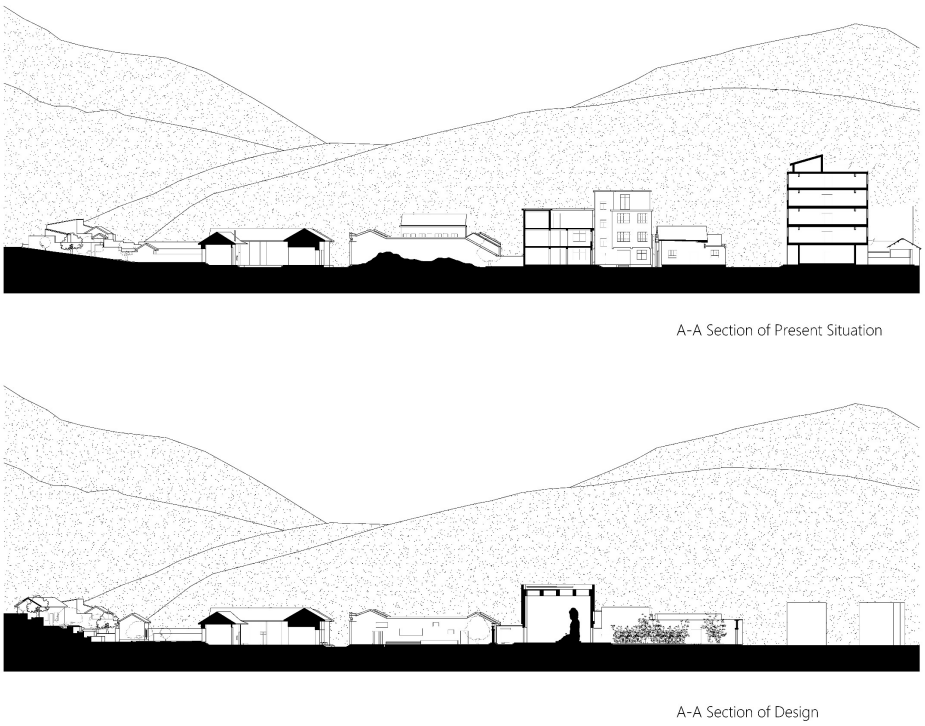


Fig. 117 Whole section of the project area

4.1.2 The history of the Temple

The construction of the Erlang Temple began in the Ming Dynasty and started during the Tianqi period. It lasted for more than ten years and was completed on the 24th of January, the third year of Ming Chongzhen (1630). At that time, the scale of the Temple was "*Eight Rooms with One Cypress*", that means, one cypress tree can be used to build eight rooms.[21, 29]

The temple property covers an area of 1666.67 ㎡. The specific layout is: there is a gate courtyard wall on the street side, 5 statue halls in the east, 3 rooms in the west, 1 stove in the south, 1 cypress tree in the courtyard, 2 incense burners and a money burner.[21]

The main hall is painted with seven colored clay sculptures, and the main is almost 3m high. The paintings on the four walls of the hall are historical characters, like Ruyi, Yunya characters.[29]

According to legend, when Li Zicheng's officers and soldiers were stationed here, they prayed in the Erlang Temple. Since then, the Erlang Temple got to extremely popular. In

the late period of the Republic of China, it was occupied and destroyed by the Kuomintang town government. After liberation of China, it was used as a school and later changed to a granary After the founding of the People's Republic of China, the Erlang Temple was changed to a place for singing and dancing. Now it is in a state of abandonment, and the inscriptions on the hall are visible, and the earth walls are 80cm thick.[21, 29]

Fig. 118 Drone view of Erlang Temple

Fig. 119 Backyard of Erlang Temple

Fig. 120 Courtyard of Erlang Temple

Fig. 121 Remaining fresco of Erlang Temple

4.1.3 Restore the significance of the Temple

Abandoned decades ago, the Erlang Temple was used to be a storage for food, a dance hall and a shop in different periods. For now, it is idle and the main hall for sacrificing had collapsed completely, while the other parts are damaged to varying degrees. Because the Erlang Temple connect to both the Yingpan Mountain and the Ancient Street directly, my design try to restore the Main Hall in a modern way while connecting the mountain and the street, which places a volume with an ancient form but replacing the

wood structure to steel and making some windows to generate some holy atmospheres, while other rooms will be some meeting and commercial space. For making the space of the Main Hall to be more perceived, the façade of the Main Hall is to be designed to a sequence of high rotatable gate, so that people can feel the fresco and the most important space of the Erlang Temple when standing in the courtyard. People could appreciate the remarkable fresco on the loft whose aim is to making visitors enjoy the heritage with different views of level.

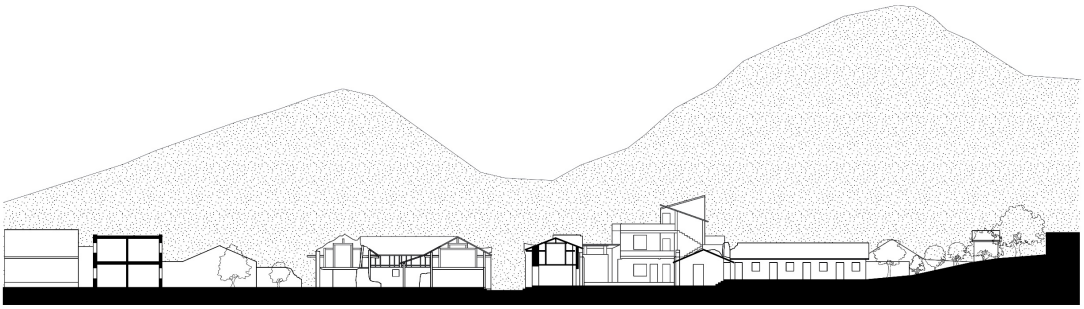
The backyard of temple was a field feeding Taoists, but now there is nothing but weeds. Since there is a building facing to the backyard of temple and located next to the Main Hall, the building will be restored and changed a room into a public space connecting the Main Hall and backyard to be a Tea room for leisure activities. Fusing the other backyard with it, this place will be built to a terraced garden and a farm stay, so that people could enjoy the views while living there.

4.1.4 Rewriting the Lacuna and Fragment from the history

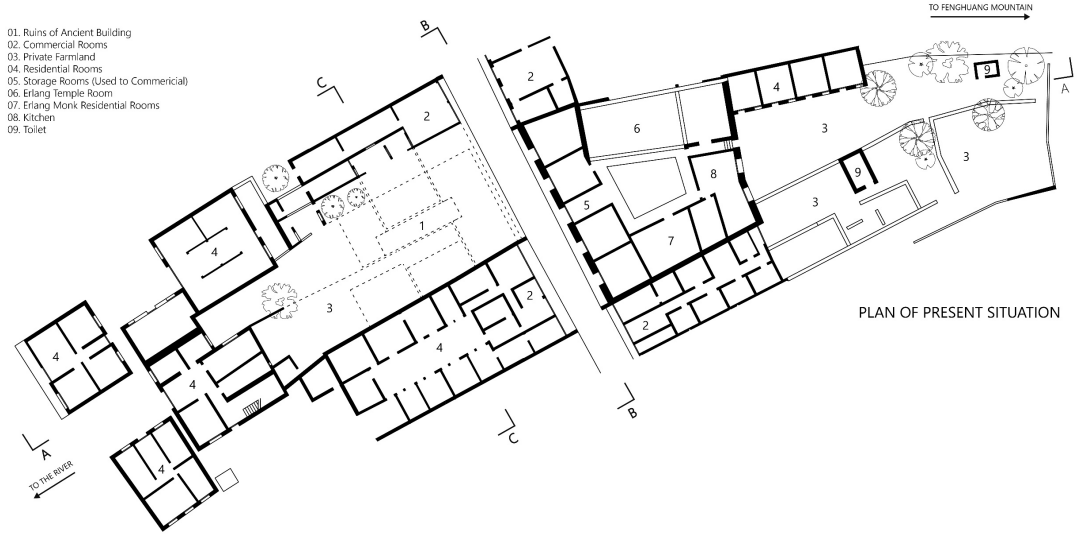
Located in the opposite of the temple, the ruins include 2 residential houses, one is demolished completely, and the other is collapsed half, which are caused by a fire in 2017. Because of lacking a suitable space in the Ancient Street, the first part is designed to a public square where could be occurred lots of activities, like retailing, exhibiting, relaxing and so on, while the other part a modern cafe. Since the other part have 3 rooms and half is damaged, the 2 rooms will be restored followed the old skills, while the rest will follow the ancient form with a modern concrete shape. The façade would be a huge glass surface, as a result, people could see the old sophisticated structure clearly. The first floor used to be storage but now we change it to suit modern life by creating double height space and placing a stair volume to solve the connection between 2 levels.

For passing through the ruins to river, some contemporary buildings will be transformed to public space, and a path would be constructed inside of these buildings. This is meaningful for both visitors and local people due to

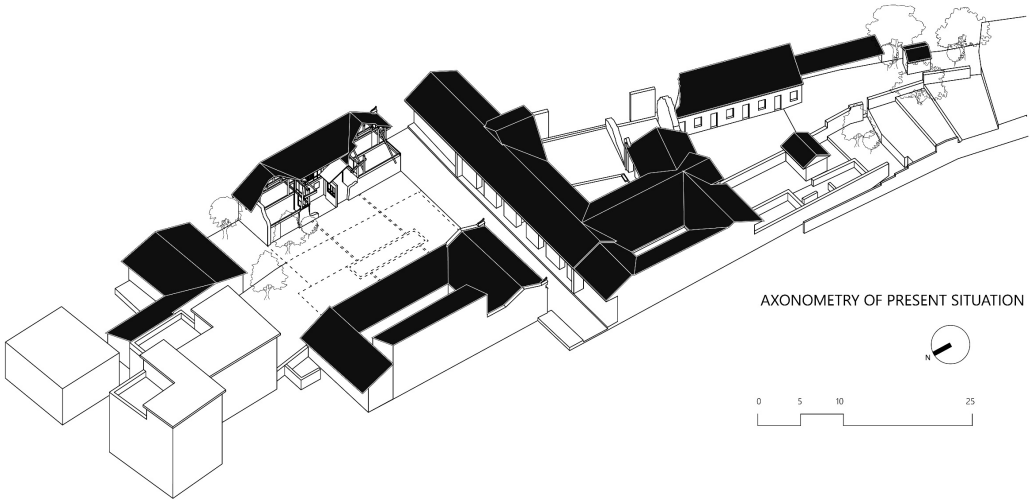
the possibilities of these new spaces, people could have more chance to communicate, to play, to merchandise, to perform and so on. In addition, we can show the indispensability of architectural culture to local people, the value of civilization, and the importance of local skills to everybody by designing spaces.



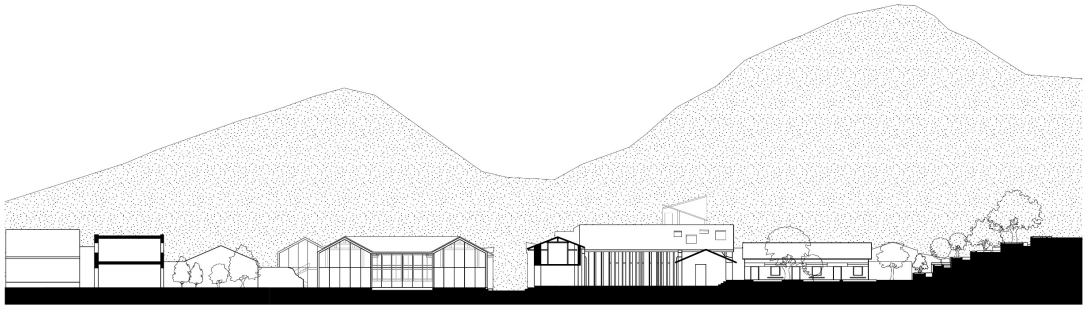
A-A SECTION OF PRESENT SITUATION



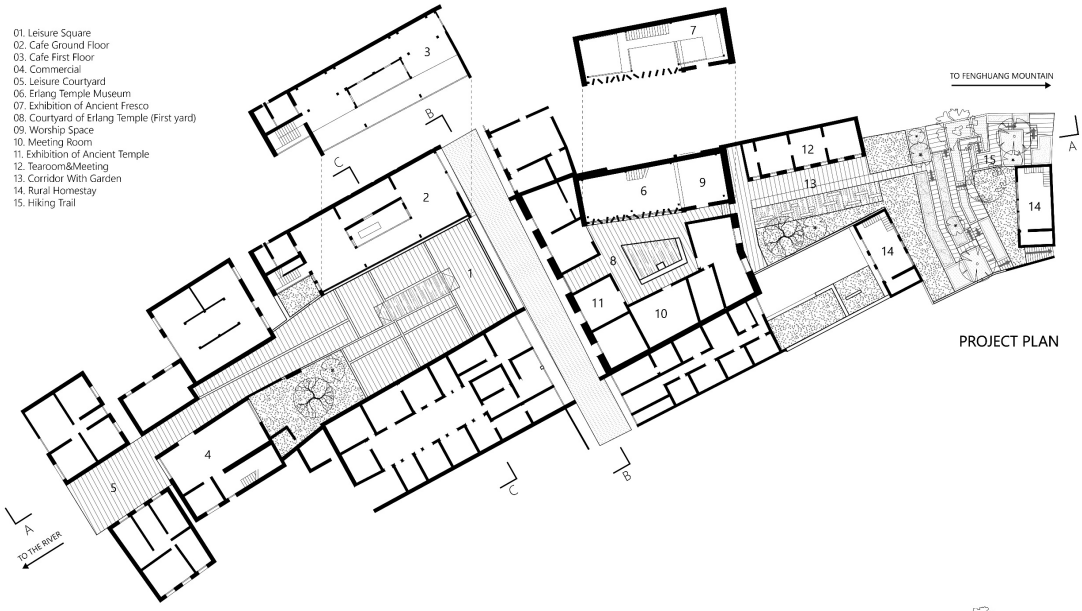
PLAN OF PRESENT SITUATION



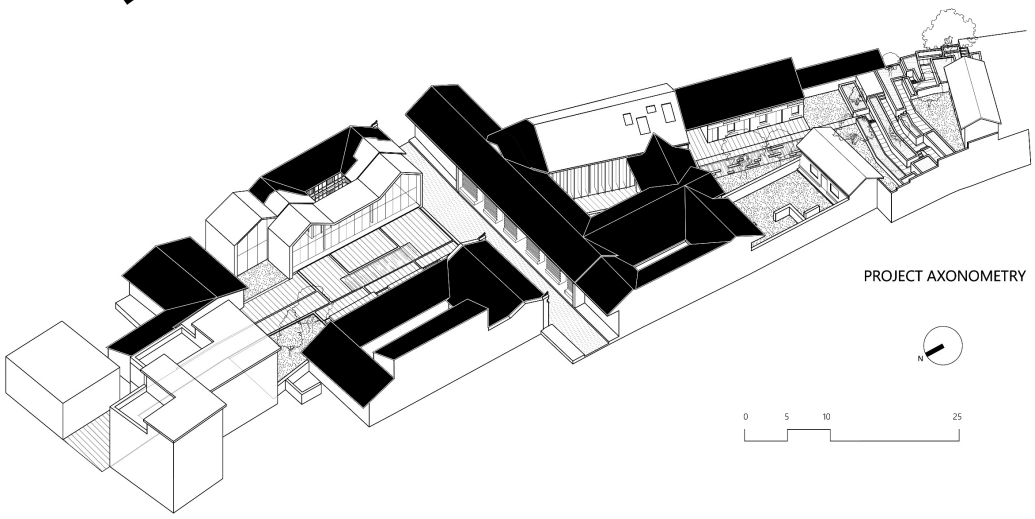
AXONOMETRY OF PRESENT SITUATION



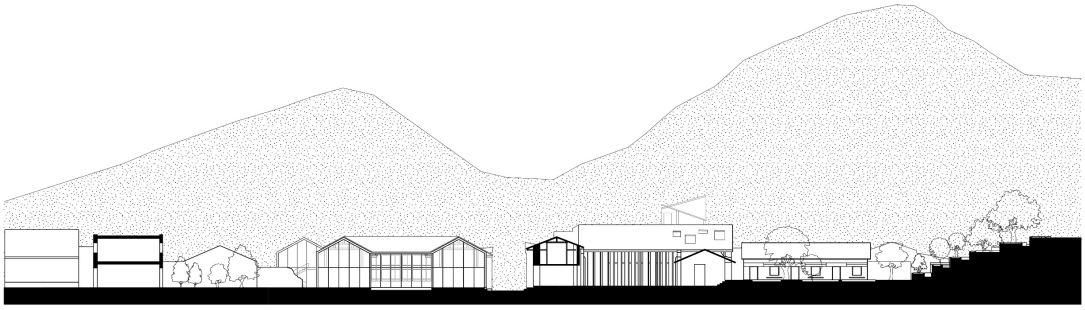
PROJECT SECTION A-A



PROJECT PLAN

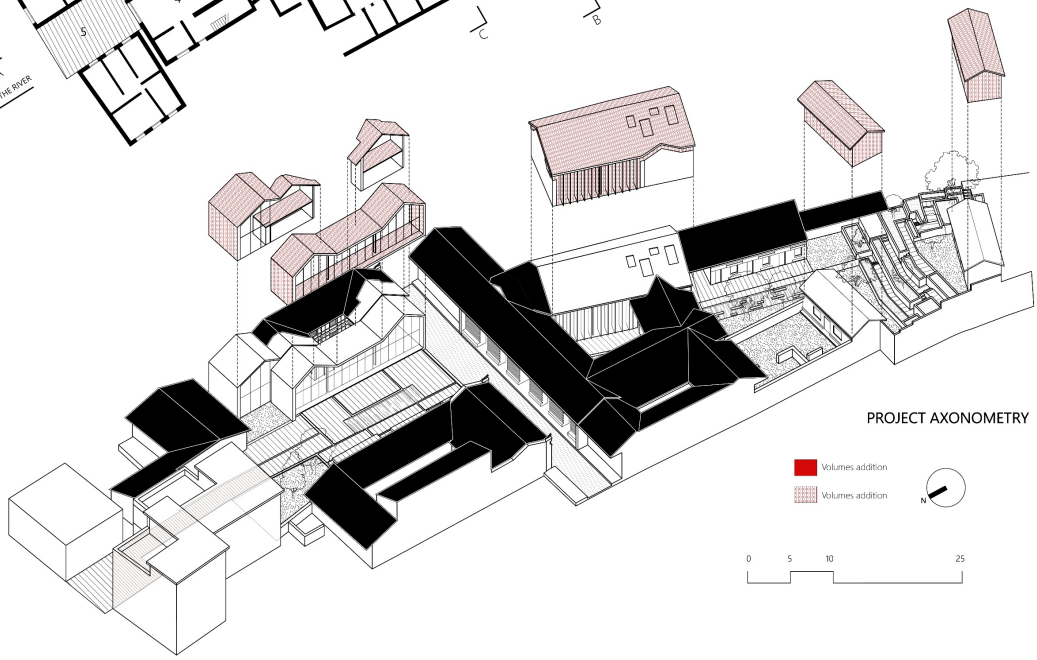


PROJECT AXONOMETRY

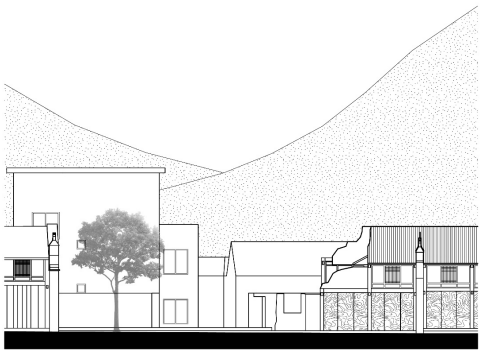


PROJECT SECTION A-A

PROJECT PLAN



PROJECT AXONOMETRY



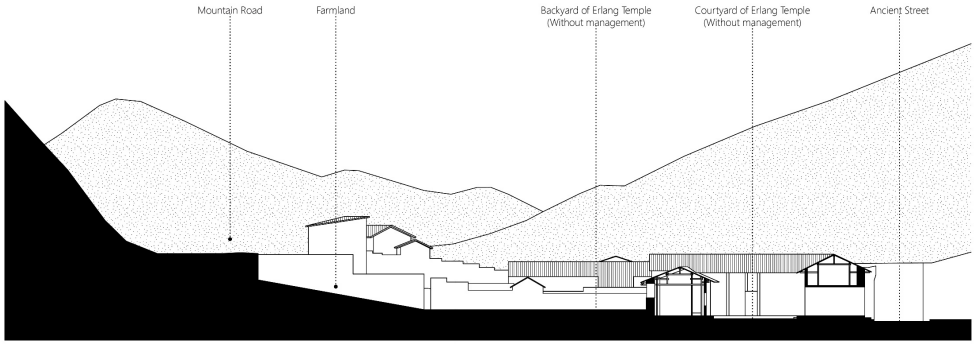
B-B SECTION OF PRESENT SITUATION

PROJECT B-B SECTION

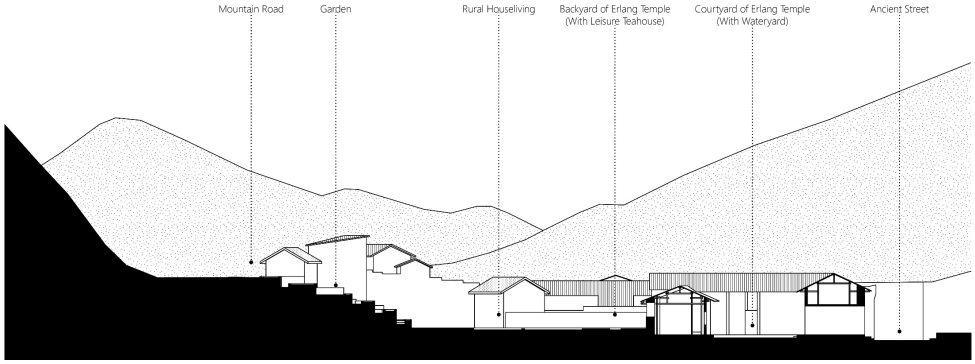
C-C SECTION OF PRESENT SITUATION

PROJECT C-C SECTION

PROJECT PERSPECTIVE IN RUINS

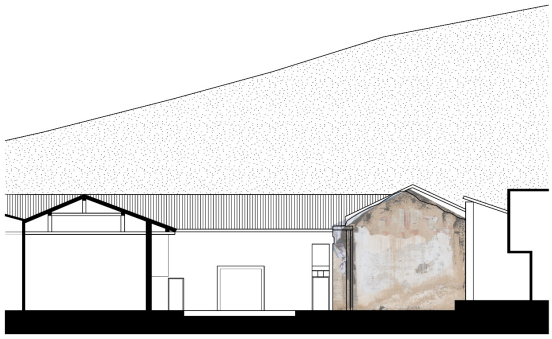


PRESENT SECTION OF ERLANG TEMPLE

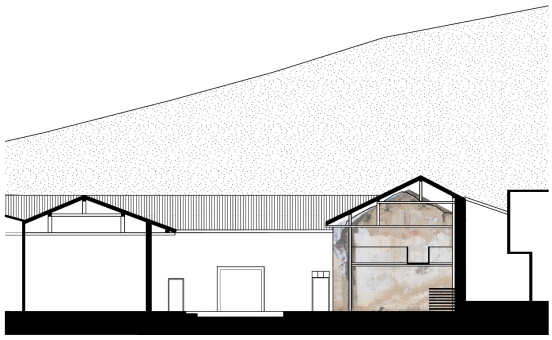


PROJECT SECTION OF ERLANG TEMPLE

PROJECT PERSPECTIVE IN BACKYARD OF ERLANG TEMPLE



PRESENT INSIDE SECTION OF ERLANG TEMPLE



PROJECT INSIDE SECTION OF ERLANG TEMPLE

PROJECT PERSPECTIVE IN COURTYARD OF ERLANG TEMPLE

PRESENT SITUATION OF RUINS IN PICTURE

Material

Wood
Earth
Clay
Plaster
Plastic
Plant

Architectural Elements & Materials

Architectural Elements & Materials

Pillars
Beams
Rafters
Timbers
White Plaster
Plastic Cover
Tiles
Transparent Tiles
Earth Layer
Mud with Straw
Vegetation
Clay Bricks
Adobes
Others

Deterioration

Hair Crack
Fracture
Damage
Erosion
Delamination
Biological Colonization

4.2 Rewriting the Modern Generic Buildings

4.2.1 The problem of the Modern Generic Buildings

There are five buildings in this area, and it could be seen very clearly that every building has its features, including earth & wood structure house, earth &wood & concrete structure house, red brick masonry structure house and concrete houses. The quality and performance of each buildings are different, but each of them is not good at all. To analyze them from the urban-plan view, some of blocks are at wrong position according to urban radial strip structure, especially some temporary house.

From another aspect, the construction of In-Between Space does not follow the growth logic of the ancient Town. Due to the abuse of the land distribution, there could not be seen the clear radial structure from drone, which is an extremely important and


① Earth&wood structure House


② Earth&wood&concrete structure House


③ Red Brick Masonry structure House

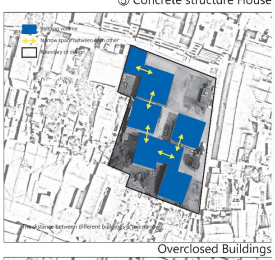

④ Concrete Structure House

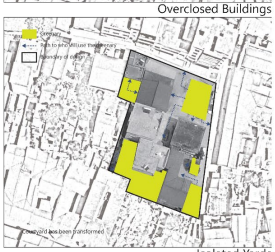

⑤ Concrete structure House

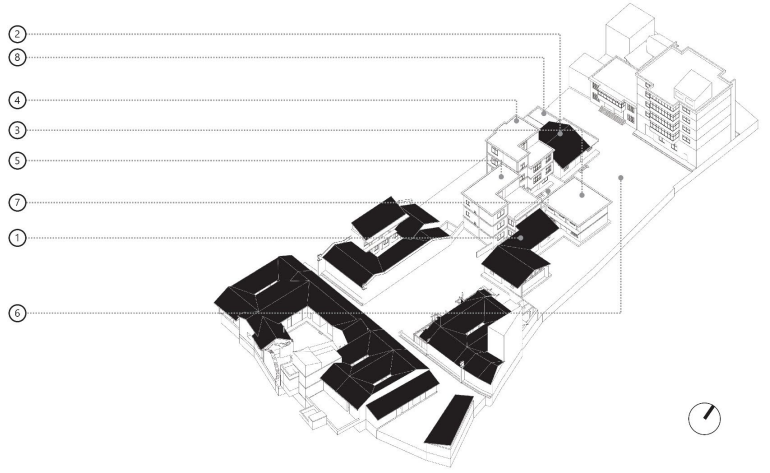

⑥ Public yard without management


⑦ Courtyard of Concrete House


⑧ Backyard of House II


Overclosed Buildings


Isolated Yards



Axonometry of Present situation

significant component to the memory of the Town.

4.2.2 Material analysis of building envelope design and details

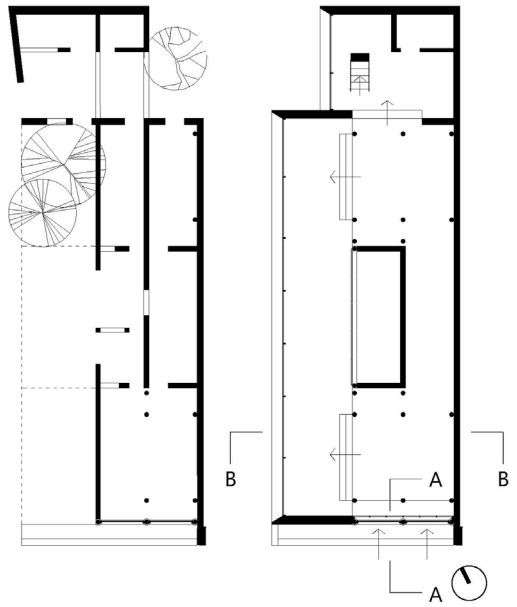


Fig. 122 Fragment ground plan with old & new

About the Fragment, the strategy is to fix the middle of its destroyed part, and using a concrete block to infill west of the missing part. The goal of the retrofitting is to improve the performance of the building energy. The original ground is rammed soil, which is not resistant to moisture. The transformed floor uses a concrete cushion, and a wooden floor above it is used to reduce noise and achieve a certain aesthetic effect. The original walls and windows are simple wooden walls and wooden windows, and their thermal insulation performance is very poor. The transformed wall is insulated with sandwich wood, that is, wood is used as a decorative layer on both sides, and insulation is used inside. The glass uses double-layer Low-E glass. The original roof is a traditional wooden structure roof, and the main component of the insulation material is earth. The renovated roof retains the original internal roof ceiling and adds an insulation and waterproof layer above it. The most important part of the renovation is on the wooden facade along the Old Street. The design uses double walls to ensure internal temperature balance. The wooden boards on the facade remain in their original positions, and a glass door is added on the inside to block the ventilation and increase the insulation performance.

The wall and roof of the concrete block are integrated, so it will use a sandwich insulation method either, using a double-layer Low-E glass and rolling shutter for shading treatment on the west facade.

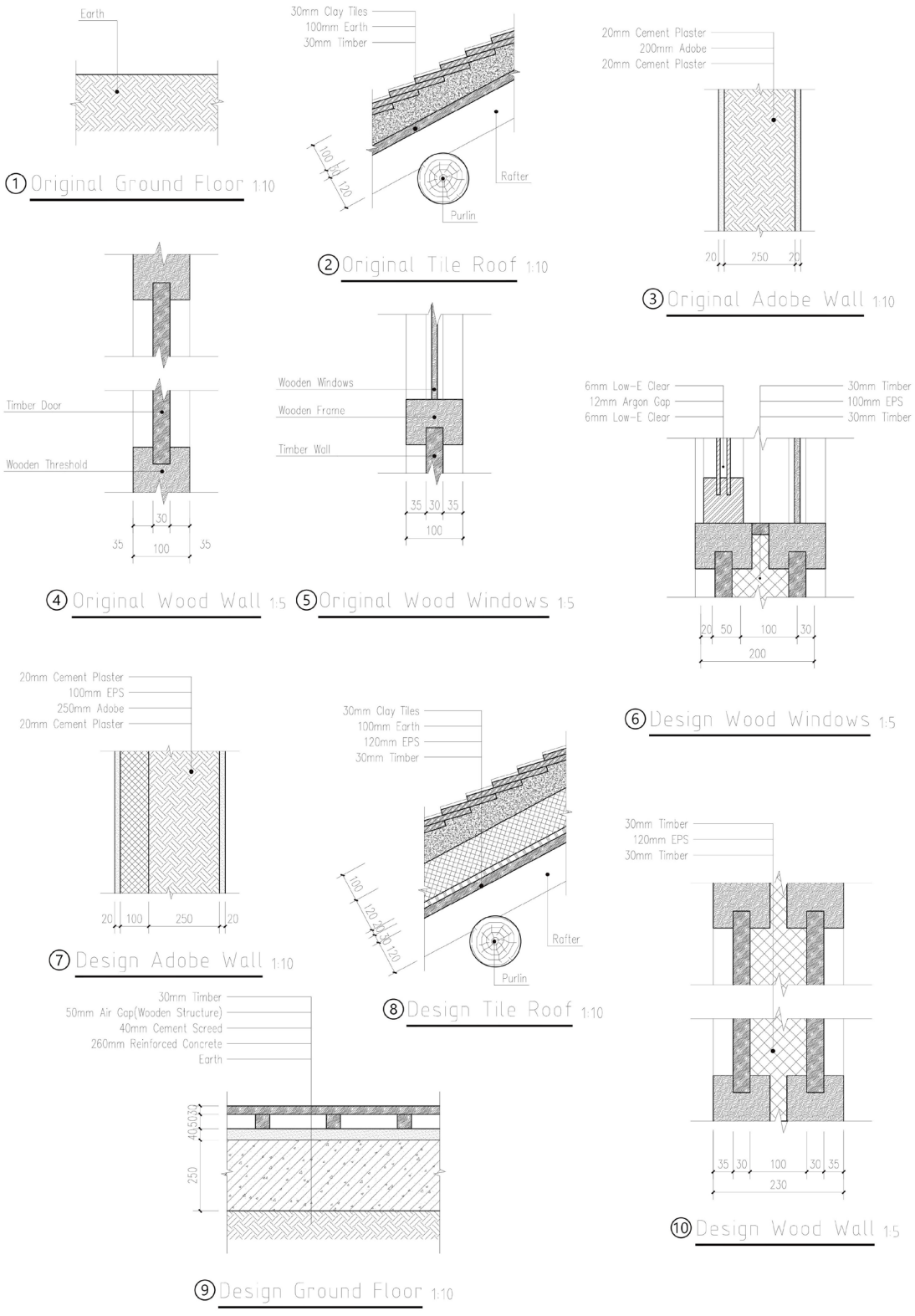
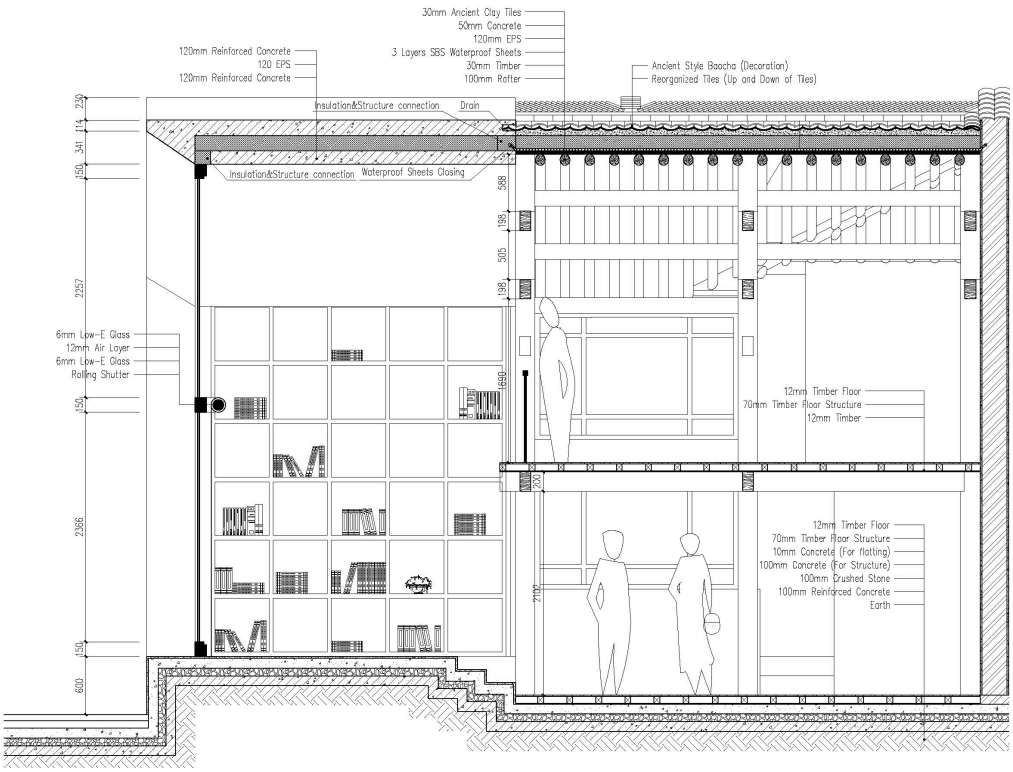


Fig. 123 U-Value of details

Wall	Original-Adobe Wall	Design-Adobe Wall	Original-Wood Wall	Design-Wood Wall(windows)
Materials	20mm cement plaster 200mm adobe 20mm cement plaster	20mm cement plaster 100mm EPS 250mm adobe 20mm cement plaster	30mm timber	30mm timber 120mm EPS 30mm timber
U-Value(W/m^{2}K)	2.63	0.29	2.63	0.26
Windows	**Original-No Glass**	**Design-Single Glass(4mm)**	**Design-Single Low-E(6mm Low-E Clear)**	**Design-Double Low-E(6mm Low-E Clear / 12mm Argon**
solar heat gain coefficient visible transmittance website	10mm timber	0.84 0.89 https://www.nationalglass.com.au/products/duo-plus/	0.74 0.83 https://www.nationalglass.com.au/products/energy-efficient-glass-loweclear/	0.62 0.73 https://www.nationalglass.com.au/products/energy-efficient-glass-loweclear/
U-Value(W/m^{2}K)	4.05	5.9	3.7	1.6
Roof	**Original-Exterior Roof**	**Design-Exterior Roof**		**Design-Concrete Wall**
Materials	clay tiles 100mm earth 30mm timber	30mm clay tiles 100mm earth 120mm EPS 30mm timber		120mm reinforced concrete 120mm EPS 120mm reinforced concrete
U-Value(W/m^{2}K)	1.67	0.24		0.27
Floor	**Original-Exterior Floor**	**Design-Exterior Floor**		
Materials	100mm earth	30mm timber 40mm cement screed 260mm reinforced concrete		
U-Value(W/m^{2}K)	0.73			

Fig. 124 Diagram of U-Value with old and new



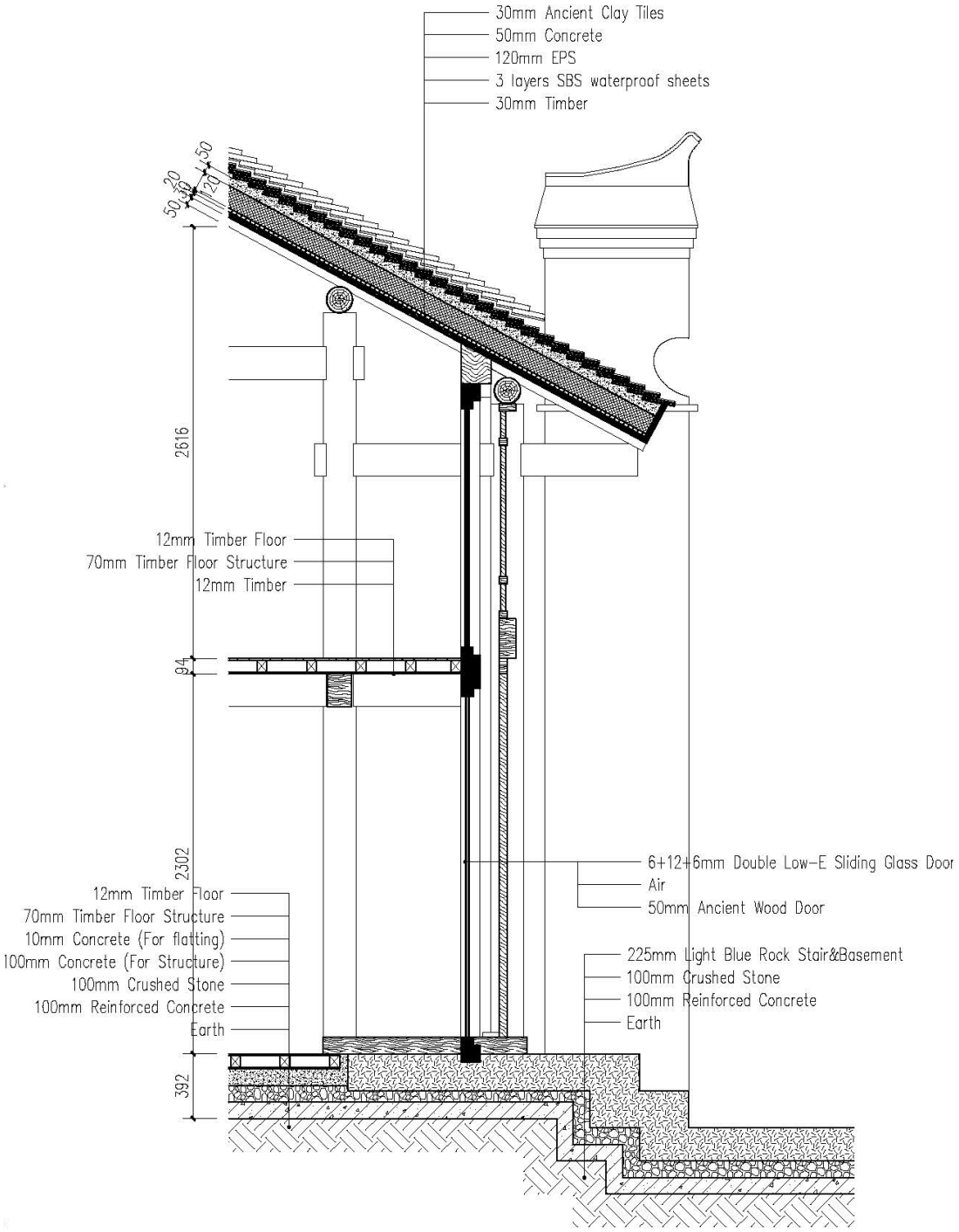


Fig. 125 Section with details

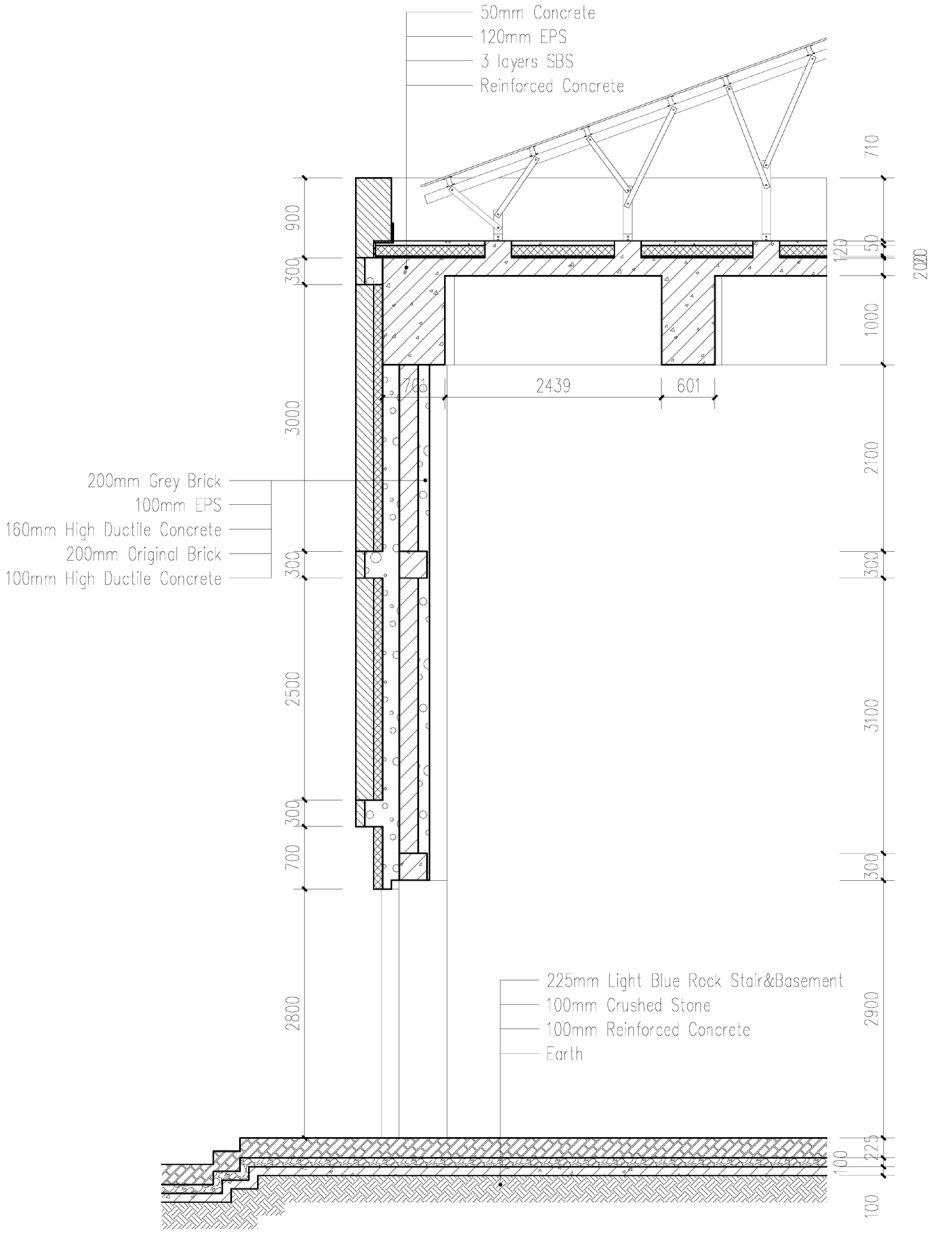


Fig. 126 The Detail of the New Urban Temple

4.2.3 Rewriting the Continuity of the Town

The target of the design is to create a new religionary temple to continue the sensibility of our ancestors, as a significant node in the Cultural Axis. The function of the In-Between Space includes culture performance, urban memory museum, old craft exhibition, urban temple and etc.

According to the previous writing, for the continuity of the Town, the In-Between Space needs to demolish 2 buildings that are located in the line of the radial structure, except that they have few values either. The author sets the Old Adobe House as the Old Craft Exhibition. The concrete building and the red brick building would be retrofitted. The In-Between Space would be divided into 3 parts referring to the urban radial structure.[23]

The most indispensable area in the In-Between Space is the middle strip of the construction of the New Urban Temple. There are 3 order as the sequence to present the sensibility of the religionary space, which include the front-yard, the hall of the New Urban Temple and the backyard. The front-yard is shaped by the new gate in front of the Lacuna piazza. The gate is proportioned from the façade of the Erlang Temple, and, for the respect of the Old Adobe House, the design breaks the connection of the gate to the House but keep the imaginary shape of a door. The material of the gate is also earth, but different from the Adobe House, it is built by the rammed earth.

The space of the New Urban Temple is retrofitted by the original concrete house. The original floors and stairs are been demolished to build a big scale space for the Buddha. For reinforcing the structure and energy performance of the building, the original wall and structure would be covered by the HDC (High Ductile Concrete), and at the outside, the combination of light grey brick and insulation would be set in the façade. The roof of the building would be rebuilt and use the Two-way Ribbed Floor to realize the long-span space. The four holes would be filled with glass for inviting more light to Buddha to highlight the sacredness.

The layout of the backyard is symmetric with path in the middle and greenery aside. The bilateral bamboos

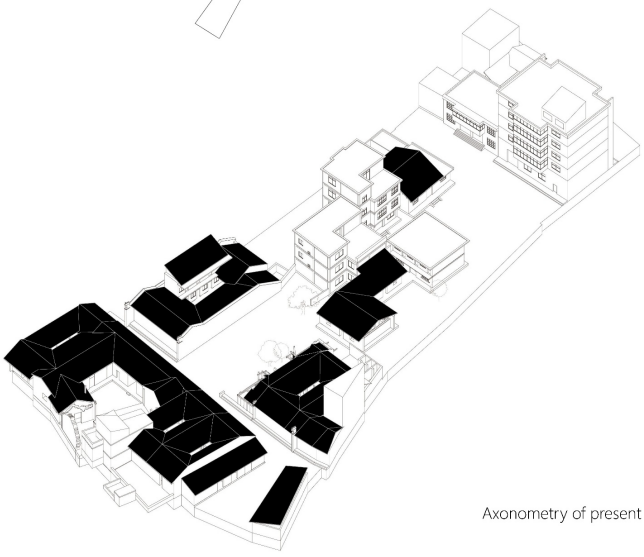
have the power to reactivate the passion of people's religion. The backyard of 3 strips is connected.

The Western strip is the Stage and Urban Memory Museum where should be hold large cultural activities. The indoor space is semi-underground with big scale, so it is possible to be more flexible to use.

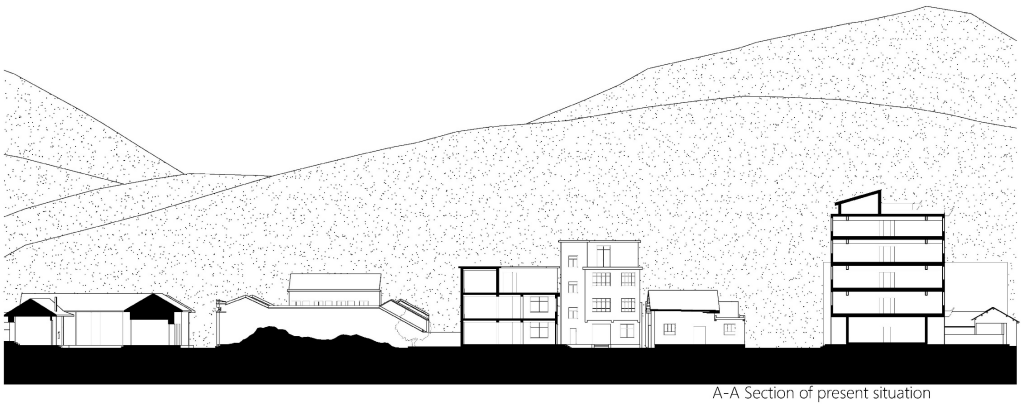
The Eastern strip contains the Old Adobe House and the retrofitted red brick house. The design set a big stair in the middle of them to shape a buffer-zone for the connection of the Old and New with a hospitable gesture. The new construction is semi-underground either to connect the retrofitted red brick house, which would be fixed following the renovation of the New Urban Temple with HDC and insulation.

01. Residential Rooms
02. Kitchen of Temple
03. Residential Rooms for Monks
04. Courtyard of the Temple
05. Storage Rooms
06. Retails
07. Ruins of Ancient Building (Whole)
08. Ruins of Ancient Building (Half)
09. Residential Rooms (Rammed Earth)
10. Residential Rooms (Concrete)
11. Residential Rooms (Red Brick)
12. Residential Rooms (Concrete&Wood)
13. Backyard of the Residential
14. Unattended Yard
15. Private Farmland

Plan of present situation

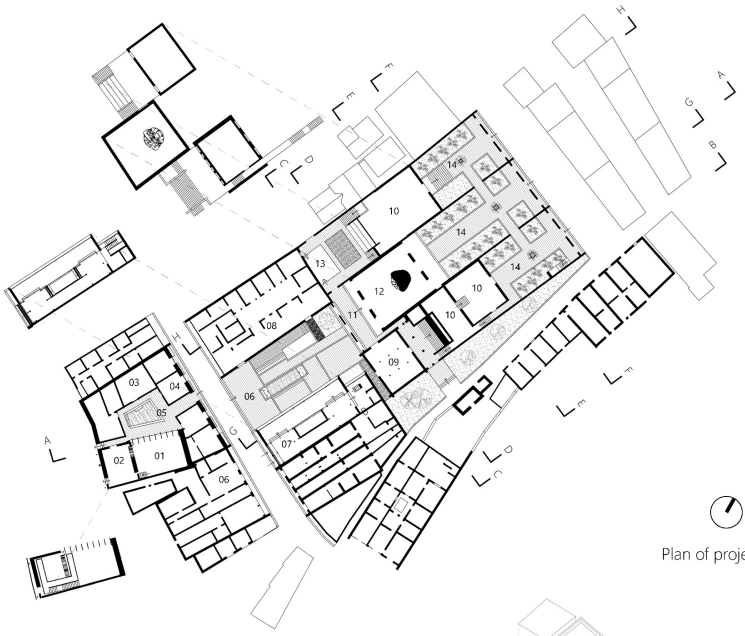


Axonometry of present situation

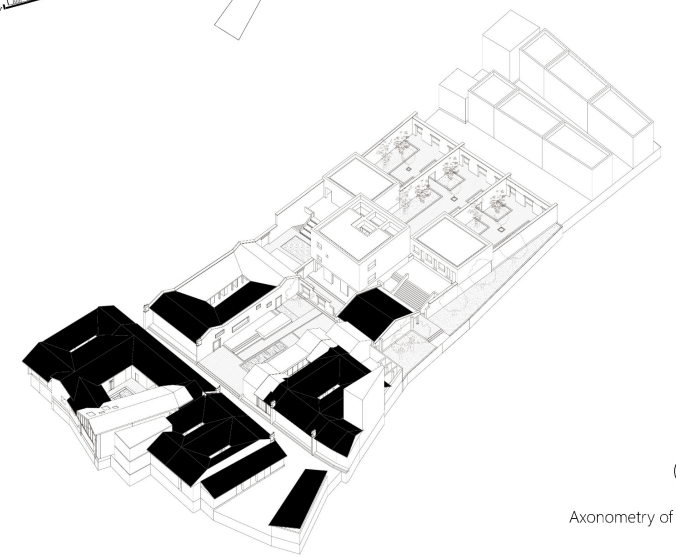


A-A Section of present situation

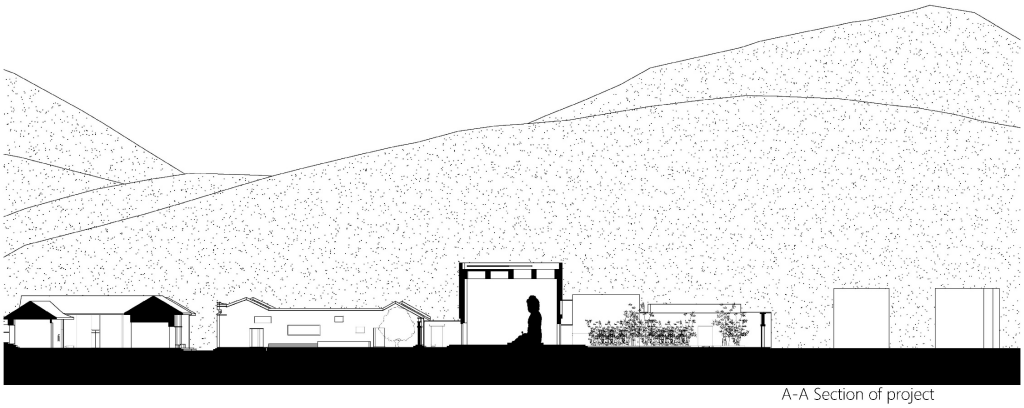
01. Exhibition of Wallruins
02. Erlang Temple Museum
03. Meeting Room
04. Exhibition of Ancient Temple
05. Courtyard of Erlang Temple
06. Leisure Square
07. Cafe & Library
08. Retails Hall
09. Exhibition of Old Crafts
10. Urban Memory Museum
11. Foreyard of Urban Temple
12. Urban Temple
13. Stage for Traditional Activities
14. Backyard of Urban Temple



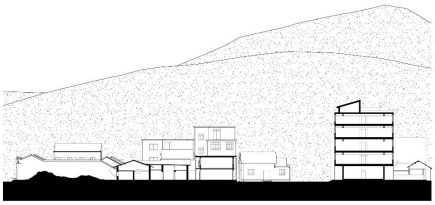
Plan of project



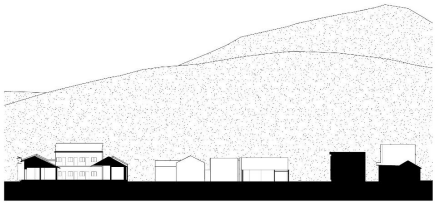
Axonometry of project



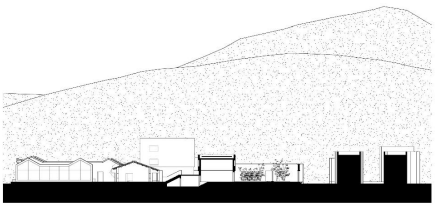
A-A Section of project



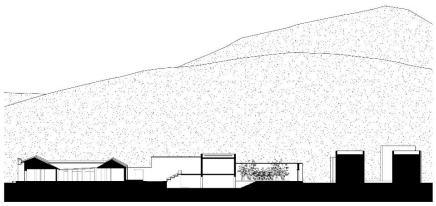
G-G Section of Present Situation



H-H Section of Present Situation

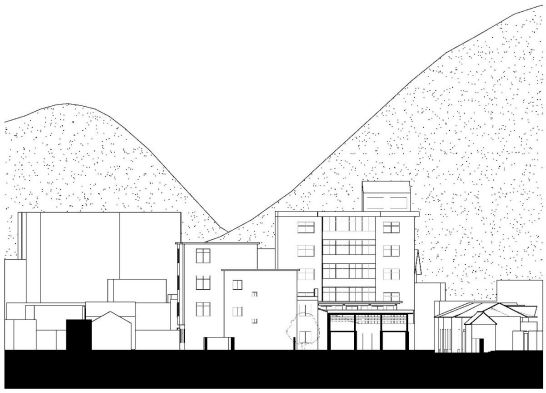


G-G Section of Design

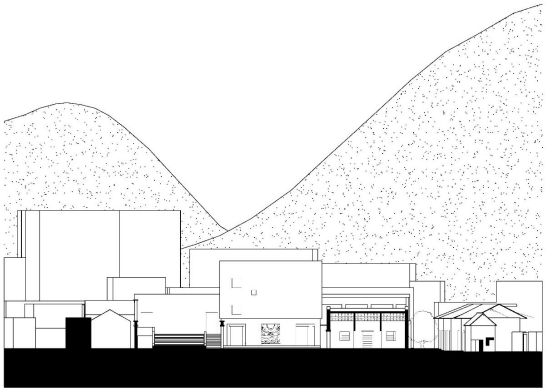


H-H Section of Design

PROJECT AERIAL PERSPECTIVE IN IN-BETWEEN SPACE



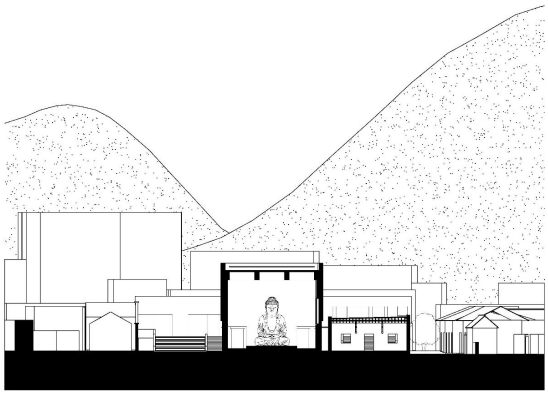
C-C Section of Present Situation



C-C Section of Design

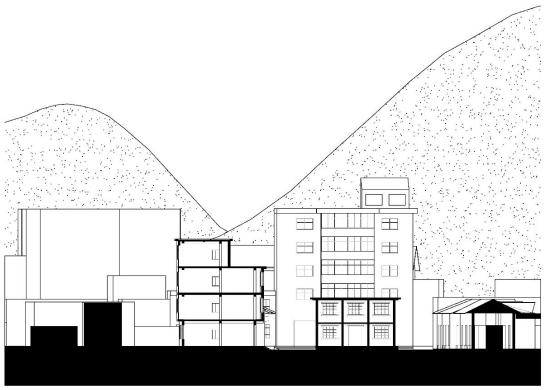
PROJECT PERSPECTIVE FROM THE OLD STREET TO IN-BETWEEN SPACE

D-D Section of Present Situation

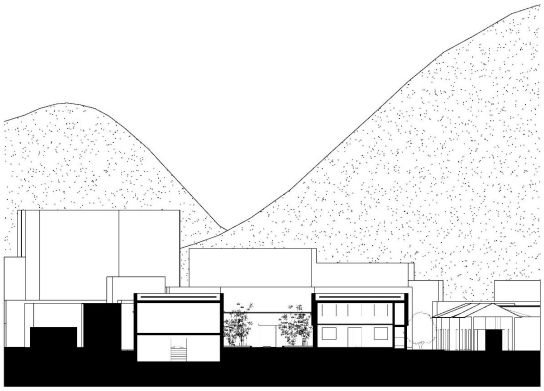


D-D Section of Design

PROJECT PERSPECTIVE OF THE NEW TEMPLE



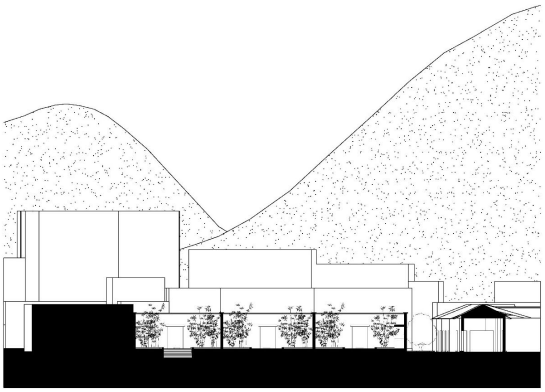
E-E Section of Present Situation



E-E Section of Design

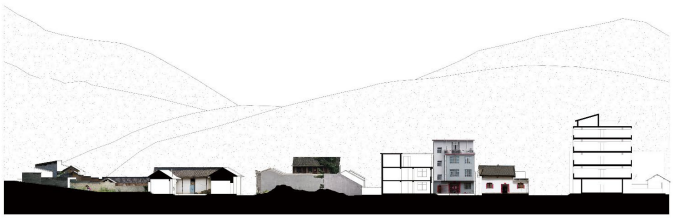
PROJECT PERSPECTIVE FROM THE STAGE

F-F Section of Present Situation

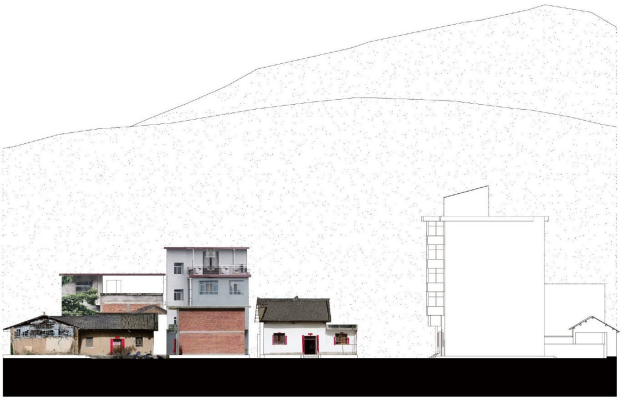


F-F Section of Design

PROJECT PERSPECTIVE OF THE BACKYARD OF THE NEW TEMPLE



A-A Section of Present Situation (with Picture)



B-B Section of Present Situation (with Picture)

C-C Section of Present Situation (with Picture)

PROJECT PERSPECTIVE UNDER THE STAIRS OF THE STAGE

4.3 Energy Design and Performance Analysis for NZEB[31]

4.3.1 Climate & Shadow analysis

The Fenghuang Town is located in central China, latitude 34.05 north, longitude 111.03 east, time zone from Greenwich is UTC + 8.

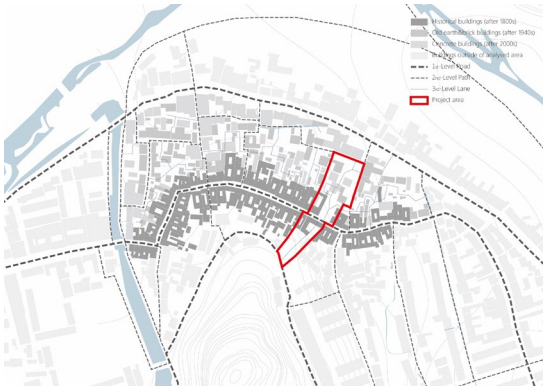


Fig. 127 Analysis of project area

Due to the lack of data from the Fenghuang Town in the international climate database, the author selected the Lushi Town with the closest data as the source of climate data.

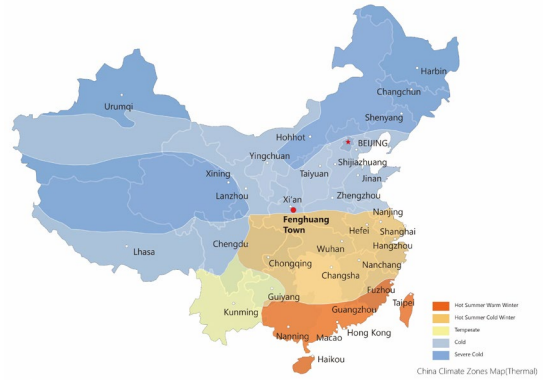


Fig. 128 China climate zones map (Thermal)

Regarding external air temperature, the Fenghuang Town is a cold area in China's climate zone, but due to the warming of the climate now, it is also hot in summer.

Fig. 129 China climate zones map (Humid)

Regarding humidity, the Town belongs to humid continent, warm summer in the climatic division. The climate is relatively humid and people's somatosensory temperature is also very high.

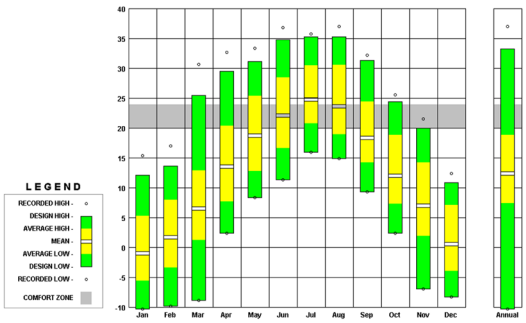


Fig. 130 Temperature range

[31] Net Zero Energy Building

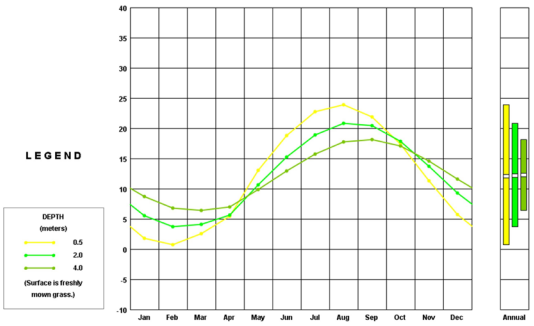


Fig. 131 Ground temperature (monthly average)

By using Climate Consultant Analysis, the author selected ASHRAE-55 Code for analysis. In February of each year, the Town has the lowest ground surface temperature, close to 0 ℃; in August of each year, the highest ground surface temperature reaches about 24℃.

The average external air temperature of the Town is the lowest in January every year, reaching minus 1 ℃, and the lowest temperature is minus 10 ℃, so the Town is relatively cold in winter. The average temperature of the Town's atmosphere is the highest in July every year, reaching about 25 ℃, and the highest temperature has reached 35 ℃, so the Town is not very hot in summer. People's physical comfort temperature is around 20-24 ℃. The average monthly temperature of the Town is only in this interval in June and August, so the necessary temperature adjustment measures during architectural design need to be set.

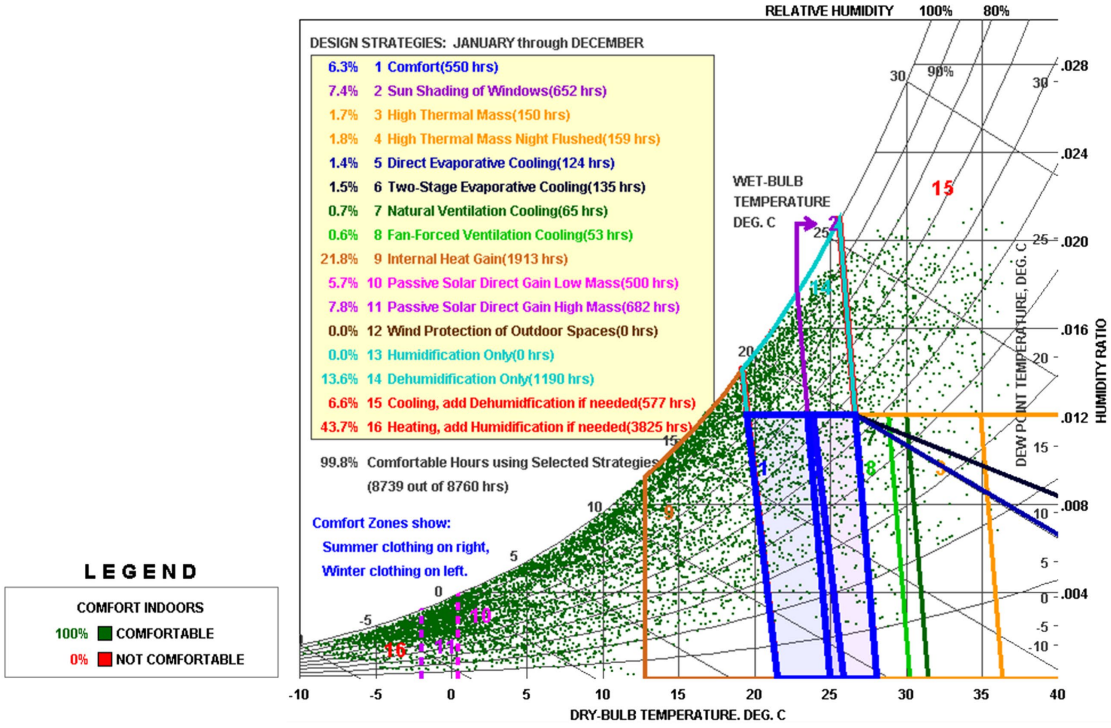


Fig. 132 Psychometric chart

By analyzing the psychometric chart, it can be seen that only 4.7% of the year is comfortable in the climate, 49.7% of the time needs to be improved by heating, add humidification if needed, and 22.9% of the time needs to be improved by internal heat gain. The demand for cooling in the Town is only 7.6% of the time. Most cooling can be achieved through natural ventilation and fan-forced ventilation.

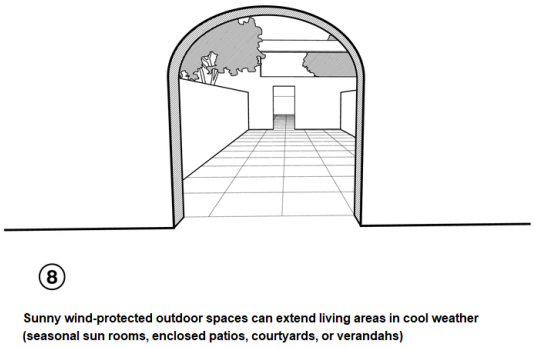


Fig. 133 Strategy given by CCA

Climate Consultant Analysis gives general strategies, including adding sunny wind-protected outdoor spaces, adding insulating blinds, heavy draperies, or operable window shutters and so on. The design will choose some effective and suitable strategies from them.

According to the geographical location of The Town, the south side of the building is the side with more sunshine. Through Ecotect Analysis software, the author simulates the town's sunshine on the summer solstice and winter solstice to observe the shadow changes in the project area. Open space has good shading in the summer solstice, and it would be better with some plants inside. About winter solstice, the roof has good sunshine situation, although some courtyard might only get sunshine in particularly time periods. Then, the author selected several important points and areas in the project site for shadow analyzed. Some buildings were affected by the sun and caused the interior to overheat, so the author will use some shading components to adjust. At the same time, the author will create the window restrainedly for the facade of the building where the sunshine is too strong.

Fig. 134 Shadow analysis in summer solstice

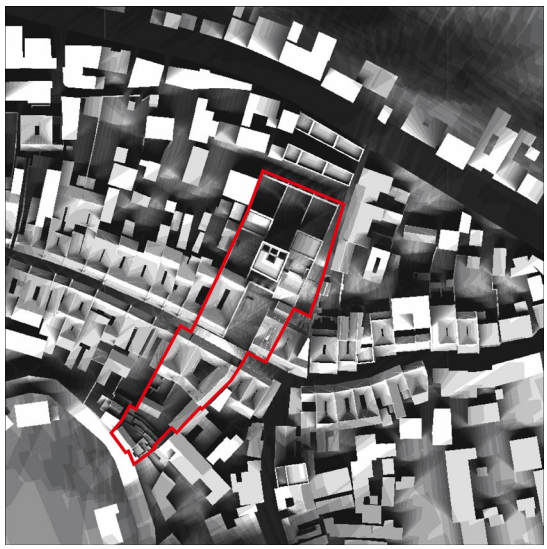
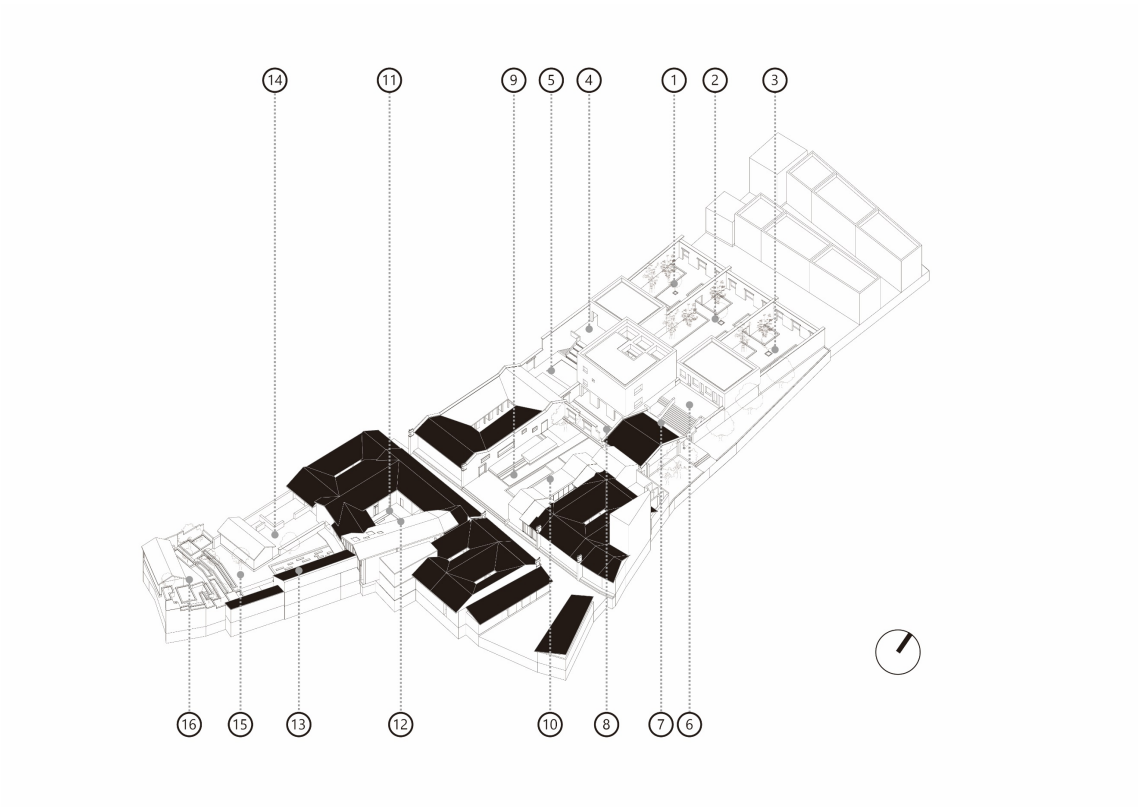
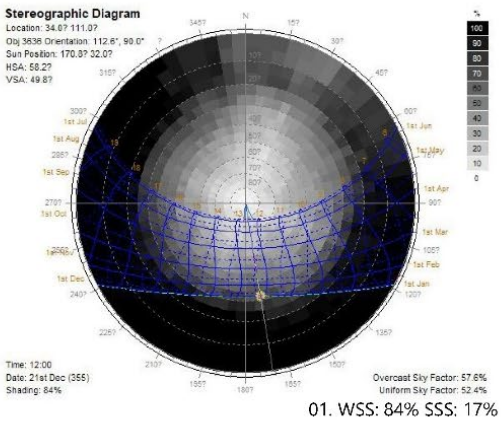
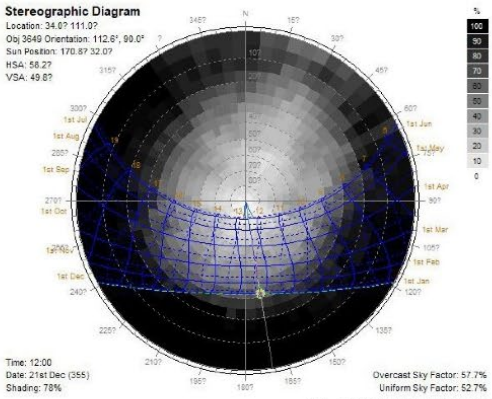


Fig. 135 Shadow analysis in winter solstice

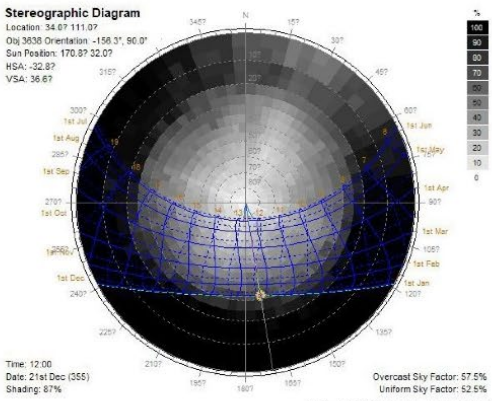




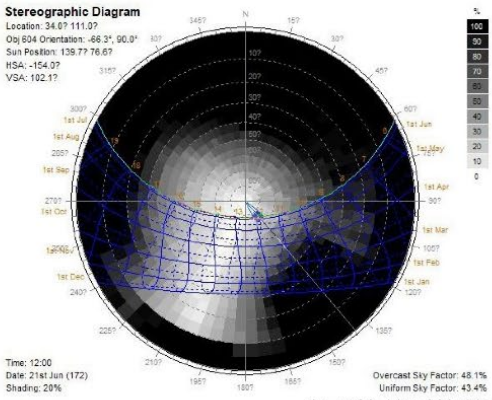
01. WSS: 84% SSS: 17%



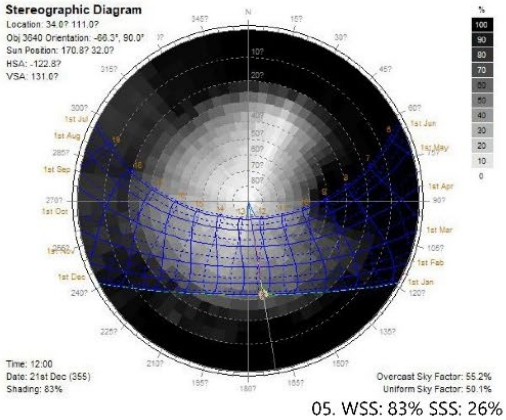
02. WSS: 78% SSS: 09%



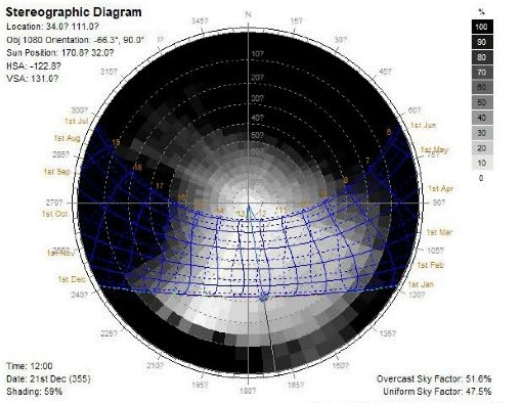
03. WSS: 87% SSS: 20%



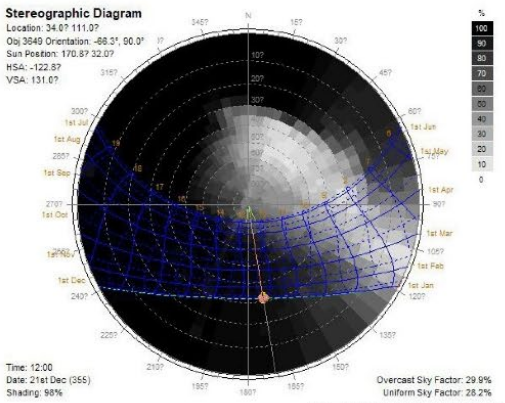
04. WSS: 82% SSS: 20%



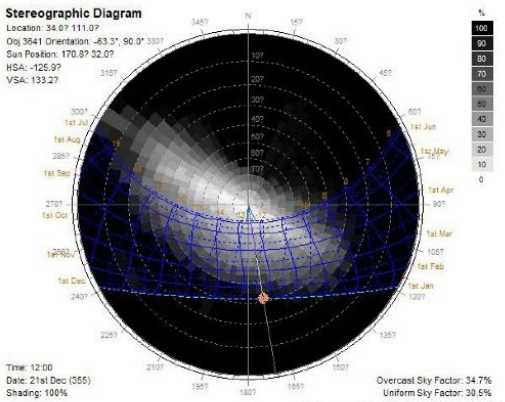
05. WSS: 83% SSS: 26%



06. WSS: 59% SSS: 07%



07. WSS: 98% SSS: 65%



08. WSS: 100% SSS: 11%

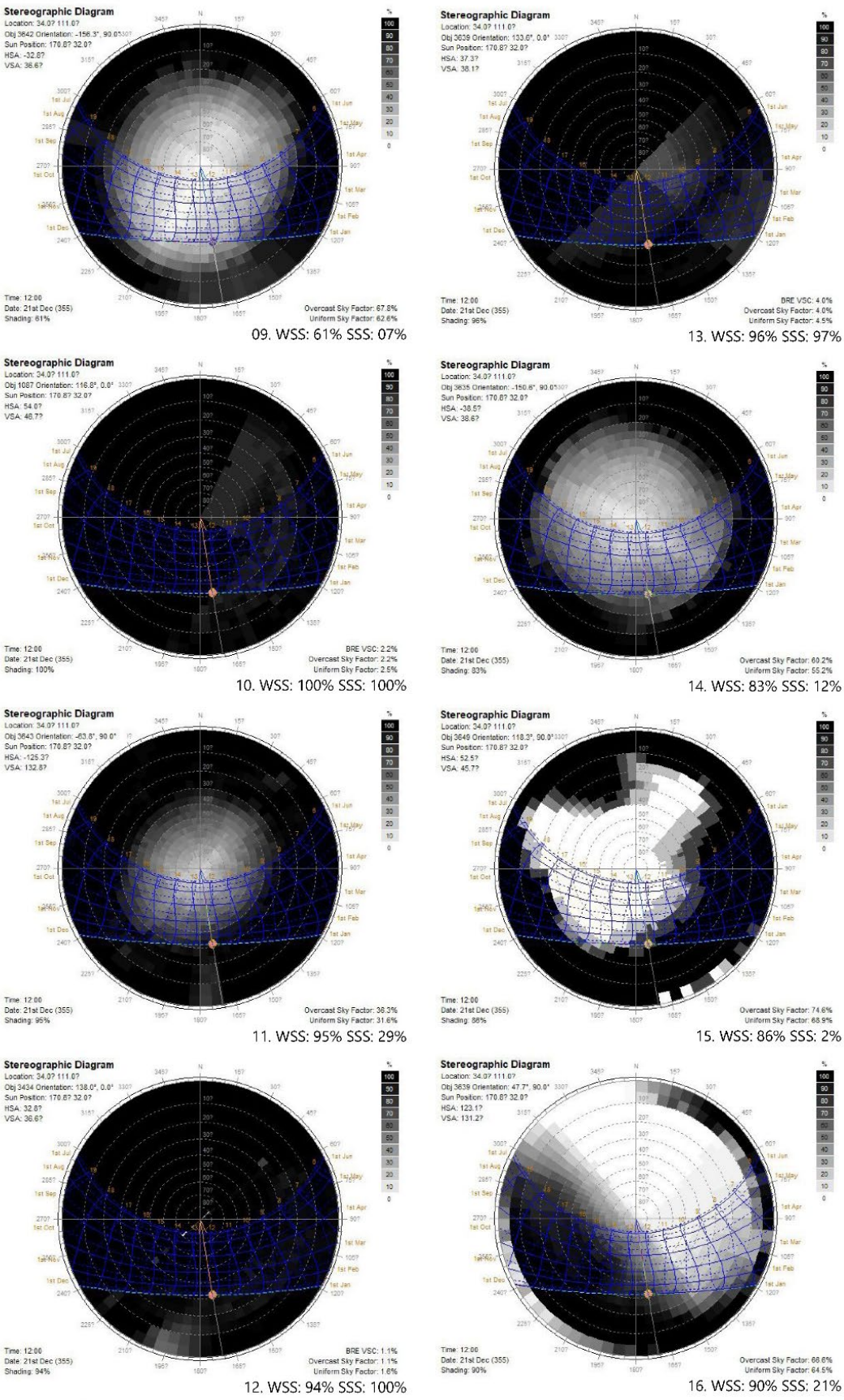


Fig. 136 Shading analysis in important piazza & facade

Fig. 137 Shading Time in project area (at winter solstice)

The author selects 16 important public spaces and facades to analyze the shading situation of the design. At the point 1,2,3 we can see that the WSS (winter solstice shading) is almost 80% and the SSS (summer solstice shading) is 20-26%, the author choose to plant a lot of bamboos to add more shading area and time; at the point 4,5, in the stage area the author make the wall higher to create more shading area for audience; at the point 6,7, the author use the New Urban Temple as a shading object to give more sensibility to the space; at the point 9,10, the author try to make a balance between to exhibit the old craft in the Fragment and more shading area, so, the roller shutters have been used in the glass façade of the Fragment; at the point 11,12, there is enough shading for the courtyard so we only need to rebuild the main room of the Erlang Temple; at the point 13,14,15,16, since there is the backyard of the Temple, different local plants have been put in suitable place.

4.3.2 The Thermal Situation of the Existing Buildings

In the project site, most of the existing building have bad thermal condition.

According to the climate of the Old Town, people are satisfied with the temperature in the summer which means they need less cooling system, but in the winter, the houses have insufficient power to resist the cold.

There are almost 4 building types in the project site, traditional adobe wall with wooden structure house, brick wall with masonry structure, concrete block with reinforced concrete column-beams structure and the temporary construction.

For the first one, because of the courtyard and easy opened wooden door in the façade, the ventilation has great performance, but the condition would be the bad in the winter. But thanks to the shared adobe wall for 2 houses, the heat could be kept well if they close the door tightly.

For the second and third, because there is no insulation in the houses and the thickness of the house is only 200mm, 240mm or 300mm, so the thermal condition is still bad in the winter, saying nothing of the temporary toilets. So, we need to design a energy supply system to satisfy the retrofitting buildings and the new.

4.3.3 Design of Energy Supply systems and Performance analysis

The author conducts analysis of heat pump and PV system by using RETScreen Energy Model. First, it queries the basic climate data of the Town and enters it into the software. According to the previous analysis, the most important thing in the Town is to choose a suitable heat source for heating in winter and provide a certain cooling in summer. Taking into account the constraints of the project area, the design uses a ground source heat pump, which is 16.5kW for rated heating capacity and 14.5kW for rated cooling capacity.

In the meanwhile, the author tries to save the energy consumption in the Cultural Axis for its publicity. The model is 50W Photovoltaic module – 450J. For the retrofitting building and new construction in the In-Between Space, the PV panels would be used on the roof directed to the south; for the buildings near the Erlang Temple, PV tiles would be used to build the new roof for balance the appearance of the Old Town. The difference of efficiency of PV panel and tiles is not big, and

they are approximately 120-150W/㎡.

By using RETScreen Heating and Cooling Load Calculation and Best Energy, the author chose to establish several Thermal zones for designing buildings to calculate heating and cooling demand and load.

For calculating the max heating and cooling load, we can get the design heating and cooling load. Then, through the RETScreen, the author gets the GSHP heating and cooling energy delivered and the electricity used.

For the GSHP, the heating energy delivered of one model is 36500kW and the cooling is 21900kW, but the total heating demand is 58332.5kW and the cooling is 30542.5kW, so, there would be set 2 heat pump models in the project site.

Through these building we can see that the space of the building is more high and more big, the energy demand and load is more large.

Through calculate the whole electricity consumption and the PV delivered energy, the author tries to balance them. For lighting and equipment/appliances, the author uses the best practices data to calculate all the designing building. (all commercial function, lighting is 15kWh/㎡, equipment/ appliances is 20kWh/㎡)

At the end, the PV delivered is 31MWh and the electricity consumption is 65MWh. Although we can't supply all the energy for the designing area, but the PV system still can fix a lot of energy consumption. (The area for PV panel and tiles is limited)

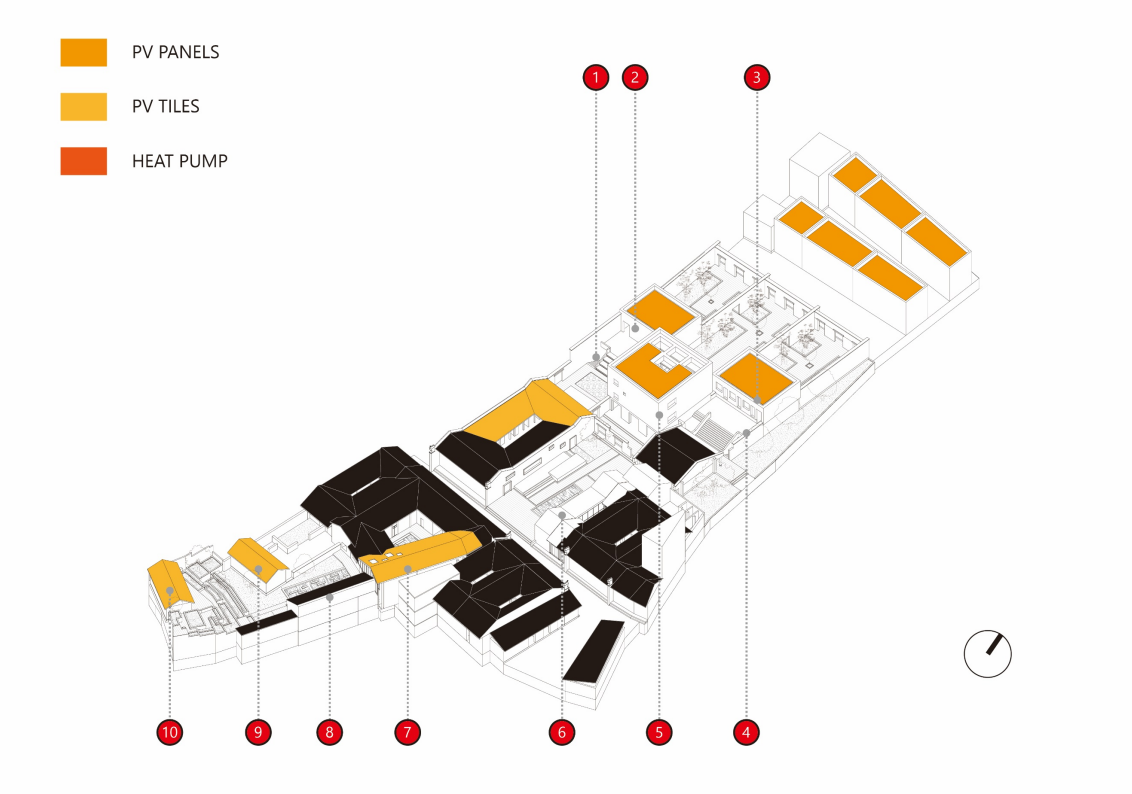


Fig. 138 Thermal zones & equipment analysis

Building	Thermal zone	Area(SQMT)		Average Height	Heating Demand(kWh)		Cooling Demand(kWh)		Heating Demand (kWh/㎡)	Cooling Demand (kWh/㎡)	Max Load Heating (kW)	Max Load Cooling (kW)
Stage Building	1	185.5	271.1	4	5008.6	7576.8	2039.4	3451.8	27.9	12.7	8.4	7.5
	2	85.6		3.4	2568.2		1412.4					
Retrofitting Museum	3	87.6	283.5	2.7	2978.4	9245.7	1797.6	5578.3	32.6	19.7	8.7	7.8
	4	195.9		2.8	6267.3		3780.7					
New Temple	5	164.4	164.4	8.7	11174.7	11174.7	6839	6839	68.0	41.6	9.1	8.7
Fragment	6	207	207	4.7	16322.9	16322.9	7872.5	7872.5	78.9	38.0	9.9	7.2
Erlang	7	133.1	133.1	6.5	10396.2	10396.2	5217.4	5217.4	78.1	39.2	9.8	7.4
Tea Room	8	39.4	39.4	4.6	1221.4	1221.4	539.8	539.8	31.0	13.7	7.2	6.3
House1	9	34.7	34.7	4.2	1154.5	1154.5	517.2	517.2	33.3	14.9	7.4	6.1
House2	10	35.5	35.5	4.2	1240.3	1240.3	526.5	526.5	34.9	14.8	7.4	6.1
Total	/	1168.7		/	58332.5		30542.5		49.9	26.1	/	/

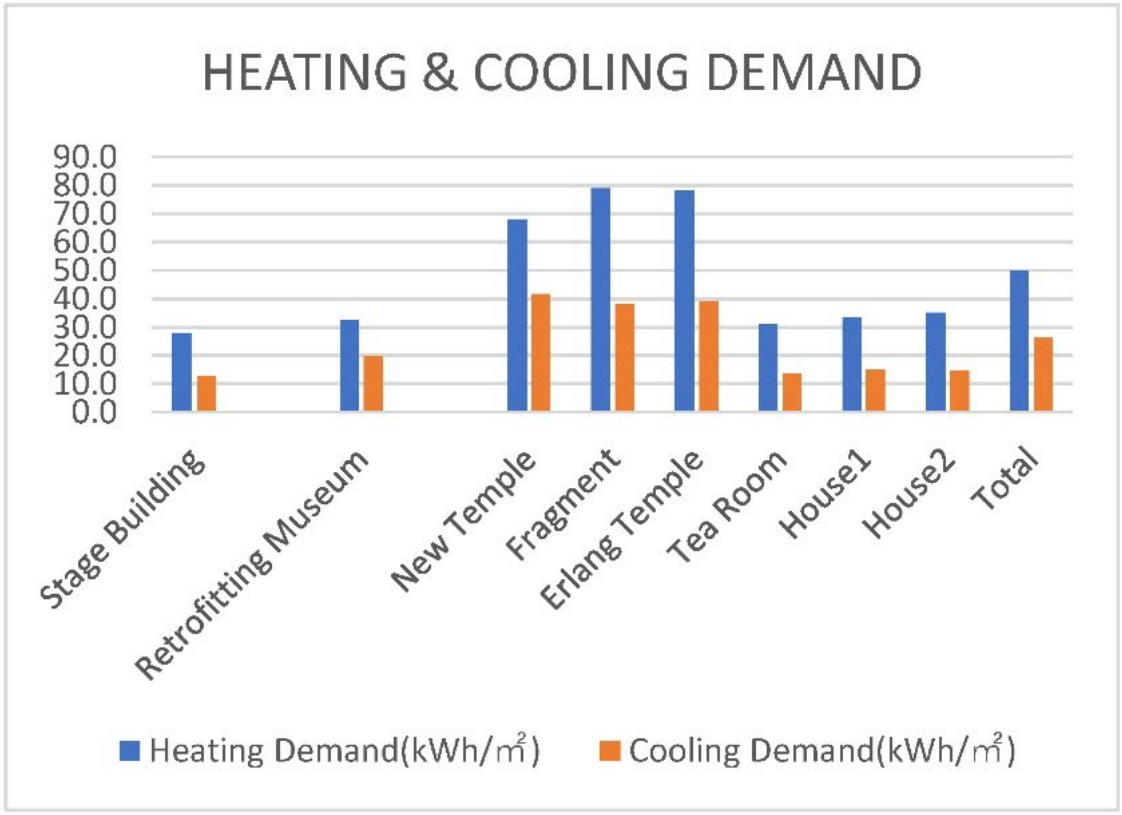
Fig. 139 The calculation of energy demand & load

Site Conditions		Estimate
Project name		**Fenghuang**
Project location		**Fenghuang, China**
Available land area	m²	109
Soil type	-	Light rock
Design heating load	kW	9.9
Design cooling load	kW	8.7

System Characteristics		Estimate
Base Case HVAC System		
Building has air-conditioning?	yes/no	Yes
Heating fuel type	-	**Electricity**
Heating system seasonal efficiency	%	100%
Air-conditioner seasonal COP	-	3.1
Ground Heat Exchanger System		
System type	-	Vertical closed-loop
Design criteria	-	Heating
Typical land area required	m²	58
Ground heat exchanger layout	-	Standard
Total borehole length	m	280
Heat Pump System		
Average heat pump efficiency	-	User-defined
Heat pump manufacturer		Customer OEM brand
Heat pump model		BGB35-135/P
Standard cooling COP	-	4.90
Standard heating COP	-	4.90
Total standard heating capacity	kW	8.6
	million Btu/h	0.029
Total standard cooling capacity	kW	12.9
	ton (cooling)	3.7
Supplemental Heating and Heat Rejection System		
Suggested supplemental heating capacity	kW	0.0
	million Btu/h	0.000
Suggested supplemental heat rejection	kW	0.0
	million Btu/h	0.000

Annual Energy Production		Estimate
Heating		
Electricity used	MWh	7.4
Supplemental energy delivered	MWh	0.0
GSHP heating energy delivered	MWh	**36.5**
	million Btu	124.6
Seasonal heating COP	-	4.9
Cooling		
Electricity used	MWh	4.8
GSHP cooling energy delivered	MWh	**21.9**
	million Btu	74.8
Seasonal cooling COP	-	4.5
Seasonal cooling EER	(Btu/h)/W	15.5

Fig. 140 GSHP energy supply calculation



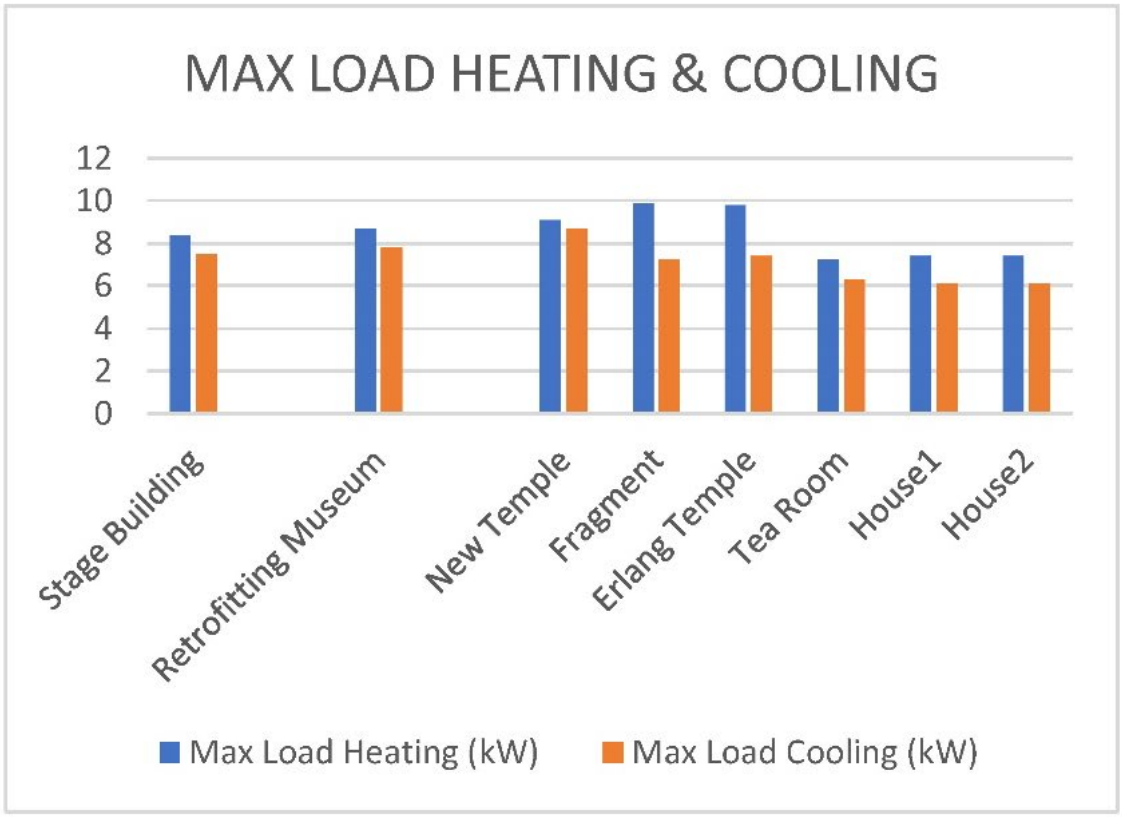


Fig. 141 Heating & Cooling demand and load in different designing buildings

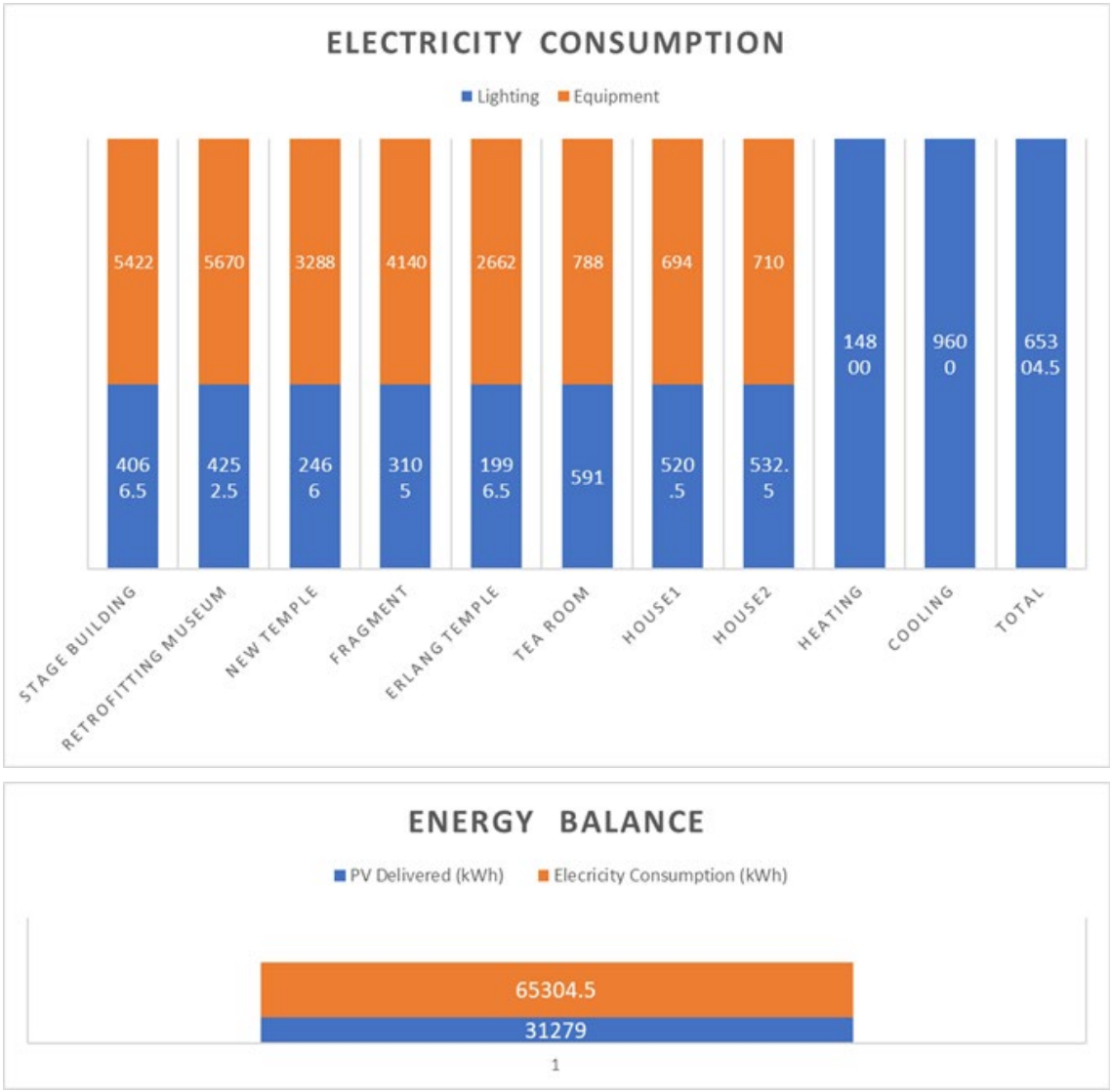
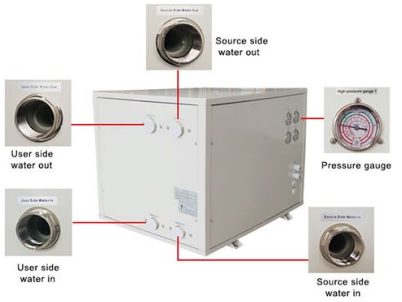


Fig. 142 The electricity consumption and energy balance analysis



monobloc ground source heat pump floor heating

Payment Type: L/C,T/T,D/P
Incoterm: FOB,CFR,CIF,EXW,FCA
Min. Order: 1 Piece/Pieces
Delivery Time: 15 Days

Model		BGB15-090/P	BGB15-105/P	BGB15-120/P	BGB15-135/P
Rated heating capacity	kw	10.5	12.5	14.5	16.5
	Btu	35000	42000	49000	56000
Rated cooling capacity	kw	9.5	11.0	13.0	14.5
	Btu	32000	37000	44000	49000
COP/EER		4.9 / 4.0	4.9 / 3.9	4.9 / 3.9	4.9 / 3.9
Heating power input	kw	2.15	2.55	2.97	3.34
Cooling power input	kw	2.4	2.8	3.3	3.7
Power supply	V/Ph/Hz	220~240/1/50~60		380~415/3/50~60	
Max outlet water temp	°C	50			
Applicable ambient temp	°C	-15~43			
Water flow volume	m³/h	1.7	2.1	2.4	2.7
Water connections	Inch	1"	1"	1"	1"
Water pressure drop	kpa	11	18	21	25
Compressor qty	PC	1	1	1	1
Container loading qty	20/40/40HQ	21/48/96	21/48/96	21/48/96	21/48/96

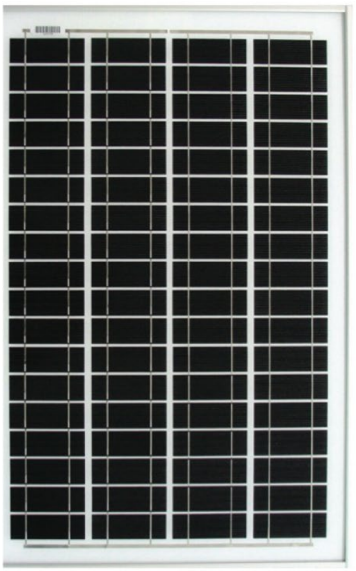
Basic Info

Model No.: BGB35-135/P

Additional Info

Packaging: Factory standard carton or Plyw... | Productivity: 3000pcs | Brand: Customer OEM brand
Transportation: Ocean,Land,Air | Place of Origin: PRC | Supply Ability: 1000 per week
Certificate: ISO 9001:2018 | HS Code: 8418612090 | Port: RONGQI,Shunde

Fig. 143 The model of heat pump



Module appearance may vary.
Cells have rounded corners with
either 165 or 150mm diameter.

50W Photovoltaic module – 450J

Electrical characteristics	(1) STC 1000W/m²	(2) NOCT 800W/m²
Maximum power (P_{max})	50W	36W
Voltage at Pmax (V_{mpp})	17.5V	15.6V
Current at Pmax (I_{mpp})	2.90A	2.32A
Short circuit current (I_{sc})	3.20A	2.59A
Open circuit voltage (V_{oc})	21.8V	19.8V
Module efficiency	11.1%	
Tolerance Pmax	± 10%	
Nominal voltage	12V	
Efficiency reduction at 200W/m²	<5% reduction (efficiency 10.5%)	
Limiting reverse current	3.20A	
Temperature coefficient of I_{sc}	0.105%/ °C	
Temperature coefficient of V_{oc}	-0.360%/ °C	
Temperature coefficient of P_{max}	-0.45%/ °C	
(3) NOCT	47 ±2 °C	
Maximum series fuse rating	8A	
Application class	Class C (according to IEC 61730-2007)	
Maximum system voltage	50V	

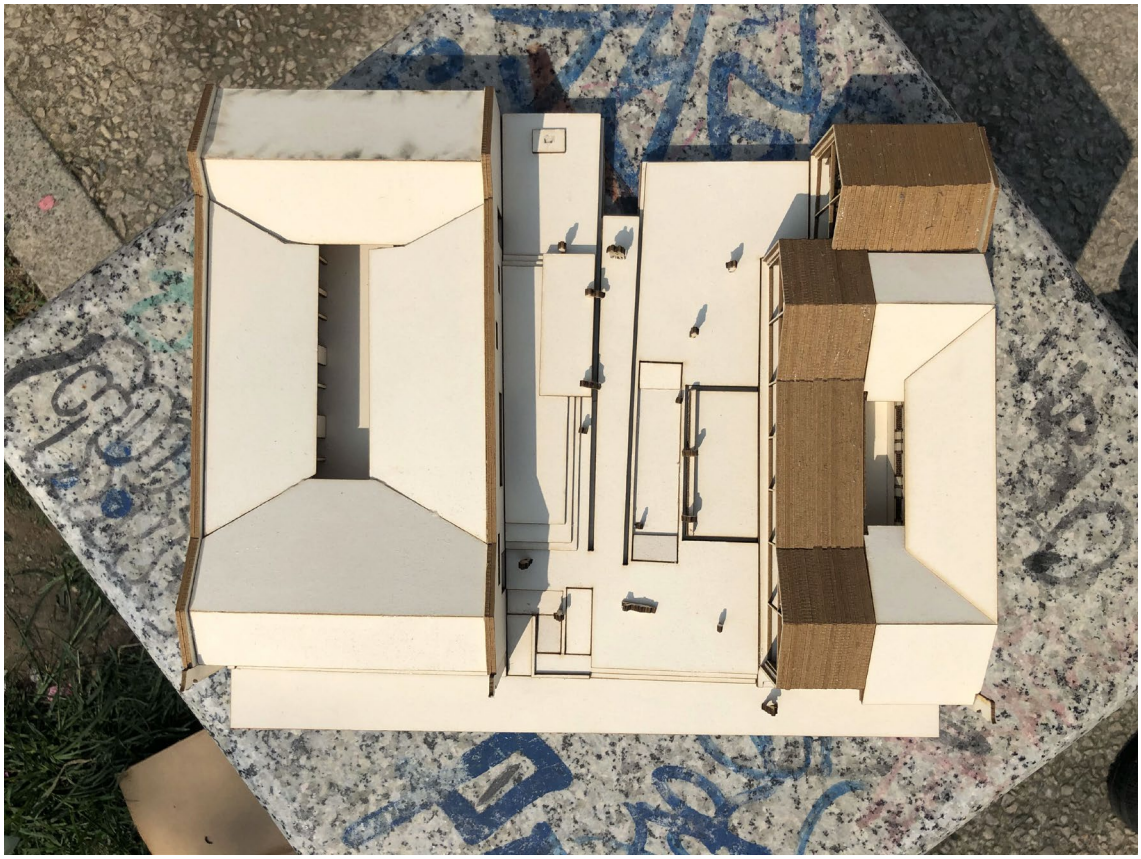
1: Values at Standard Test Conditions (STC): 1000W/m² irradiance, AM1.5 solar spectrum and 25°C module temperature
2: Values at 800W/m² irradiance, Nominal Operation Cell Temperature (NOCT) and AM1.5 solar spectrum
3: Nominal Operation Cell Temperature: Module operation temperature at 800W/m² irradiance, 20°C air temperature, 1m/s wind speed

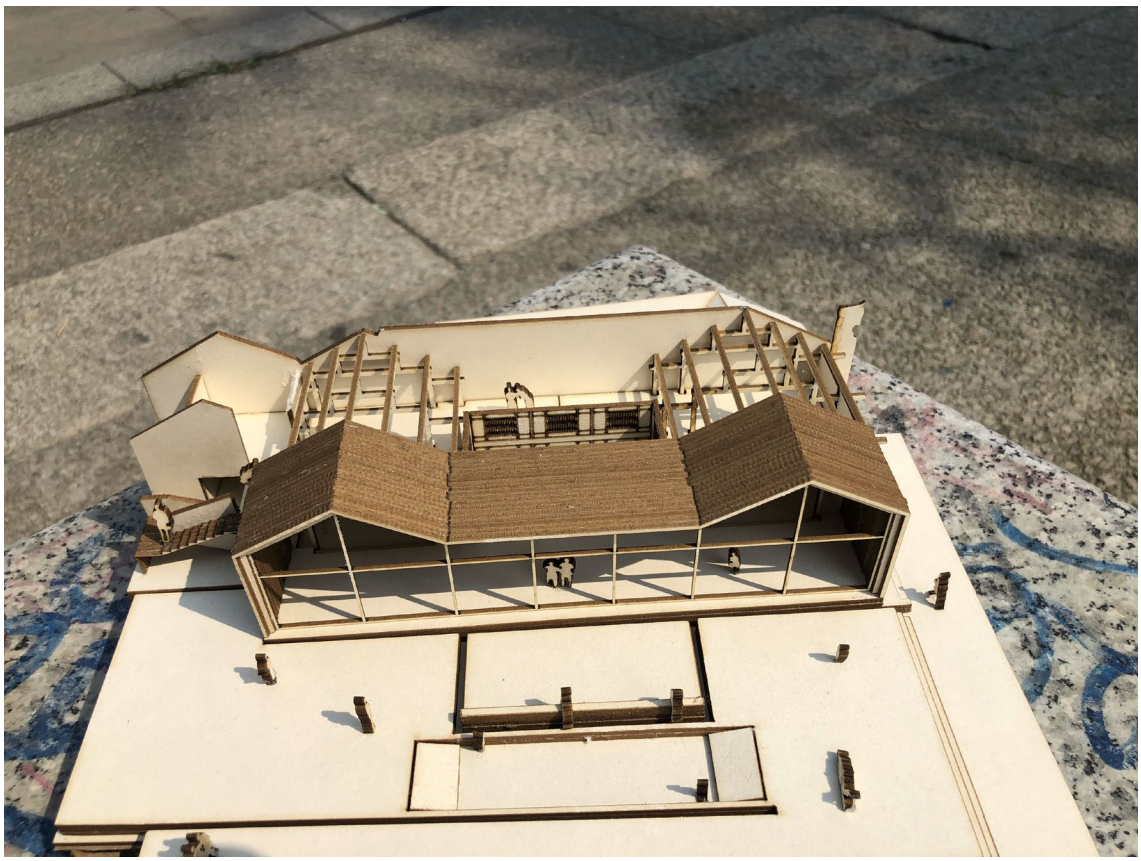
All solar modules are individually tested prior to shipment; an allowance is made within our factory measurement to account for the typical power degradation (LID effect) which occurs during the first few days of deployment.

Fig. 144 The model of PV system

Chapter V Appendix

5.1 Photo of model





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