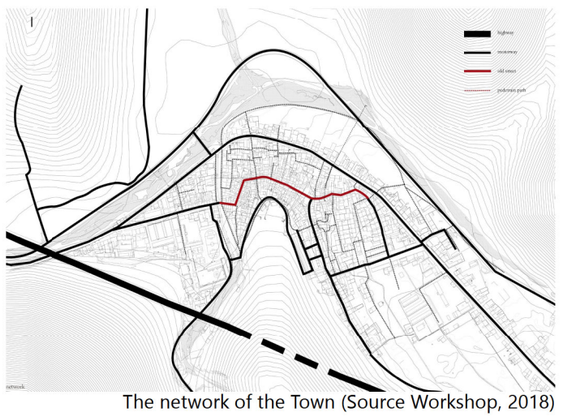
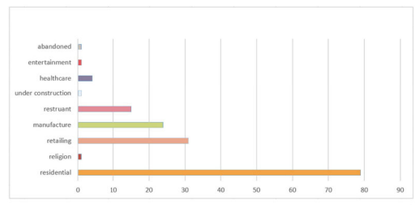
Drone view about the Fenghuang Town (Source Workshop, 2018)

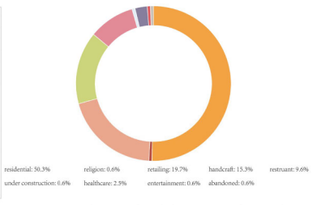
Location of Shaanxi province

Relevant main cities about the Fenghuang Town



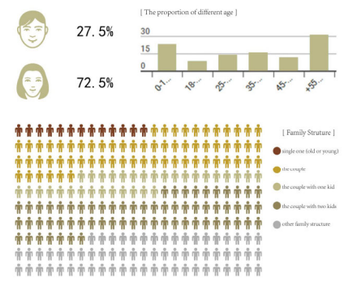
The network of the Town (Source Workshop, 2018)

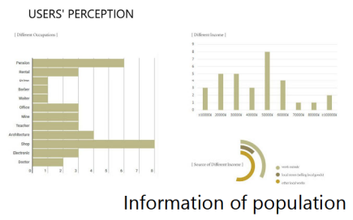




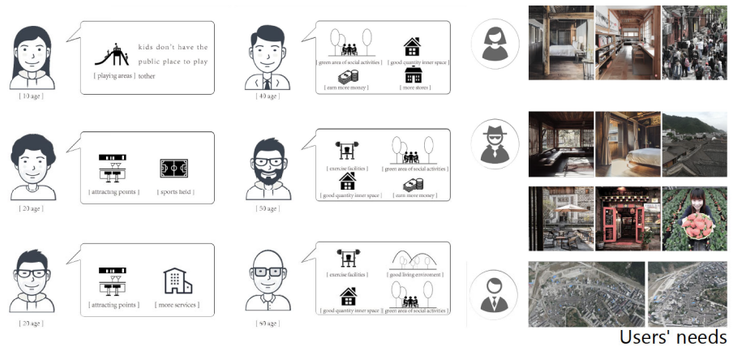
The proportion of Old Street functions

Activities & functions in 2013

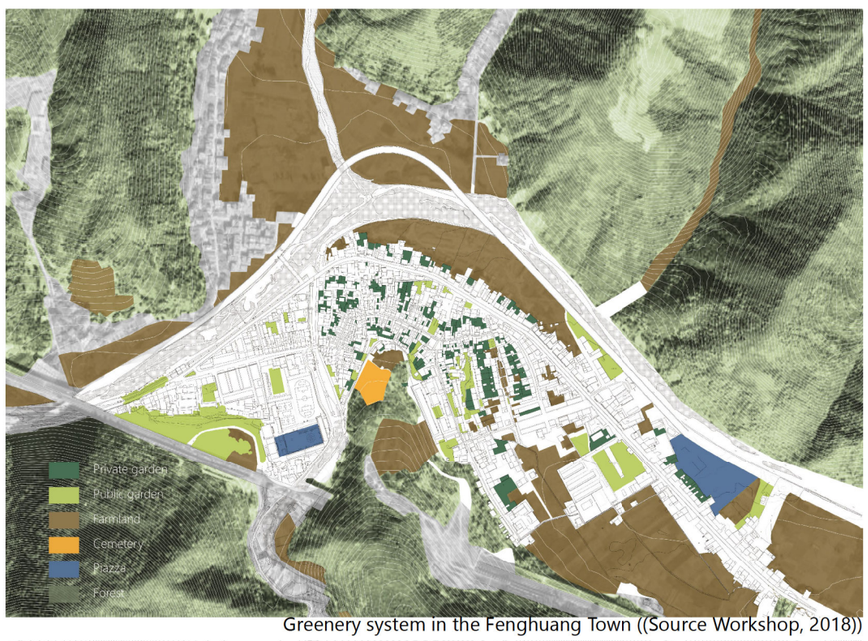




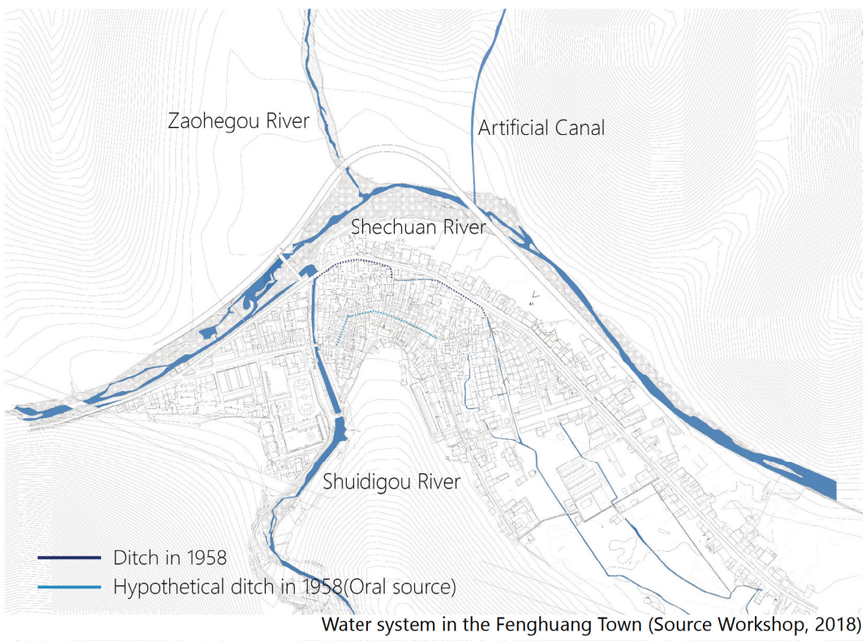
Information of population



Users' needs

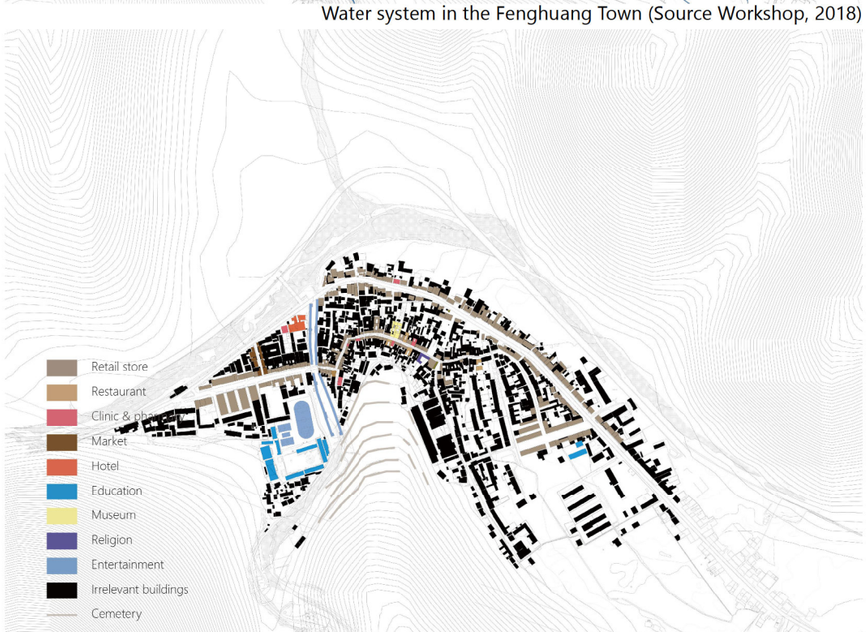


Greenery system in the Fenghuang Town ((Source Workshop, 2018))

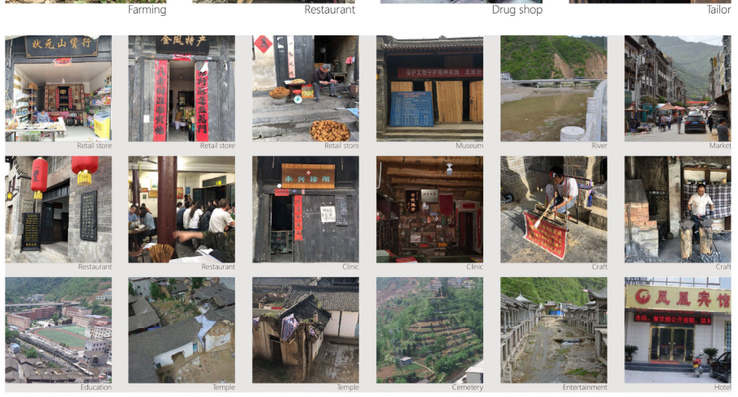


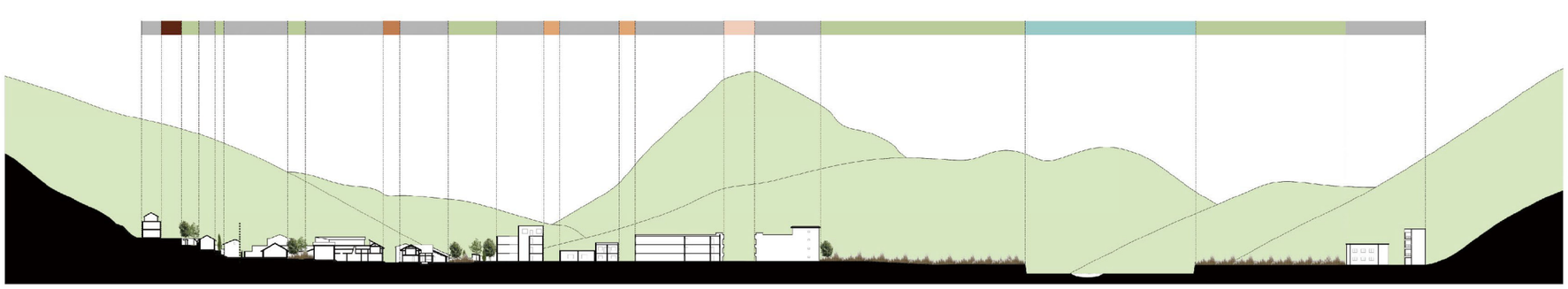
Water system in the Fenghuang Town (Source Workshop, 2018)

Building function in the Fenghuang Town (Source Workshop, 2018)



Existing Relevance in the Fenghuang Town (Source Workshop, 2018)

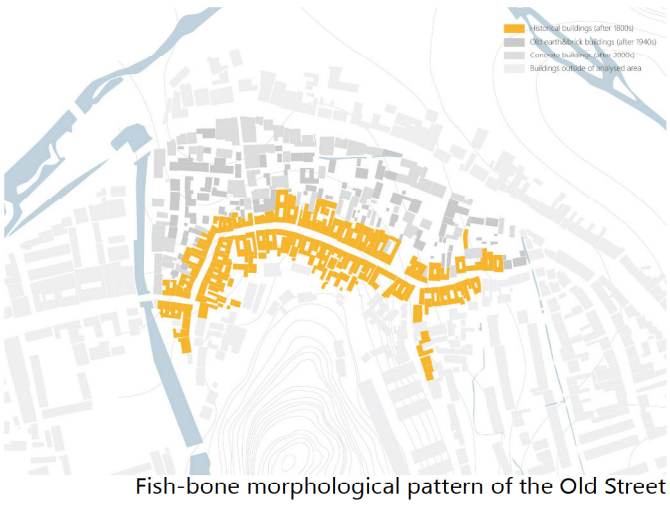




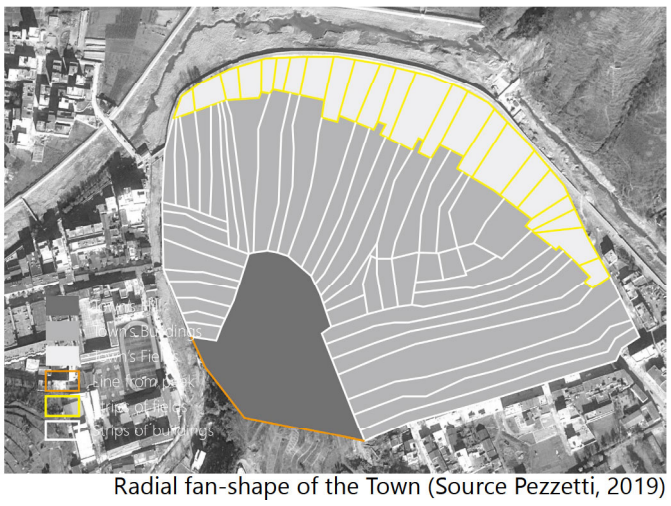
Whole section from South to North in the Fenghuang Town (Source Workshop, 2018)

Morphological characteristics of fields and buildings in 2013 (Source Pezzetti, 2019)

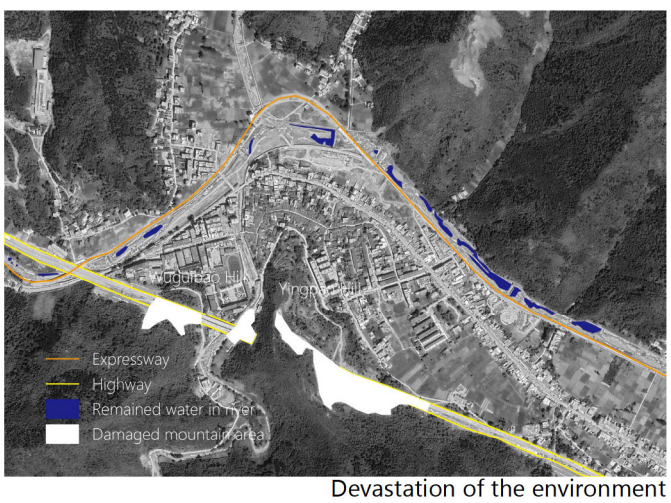
The diachronic mapping of transformation of Fenghuang Town



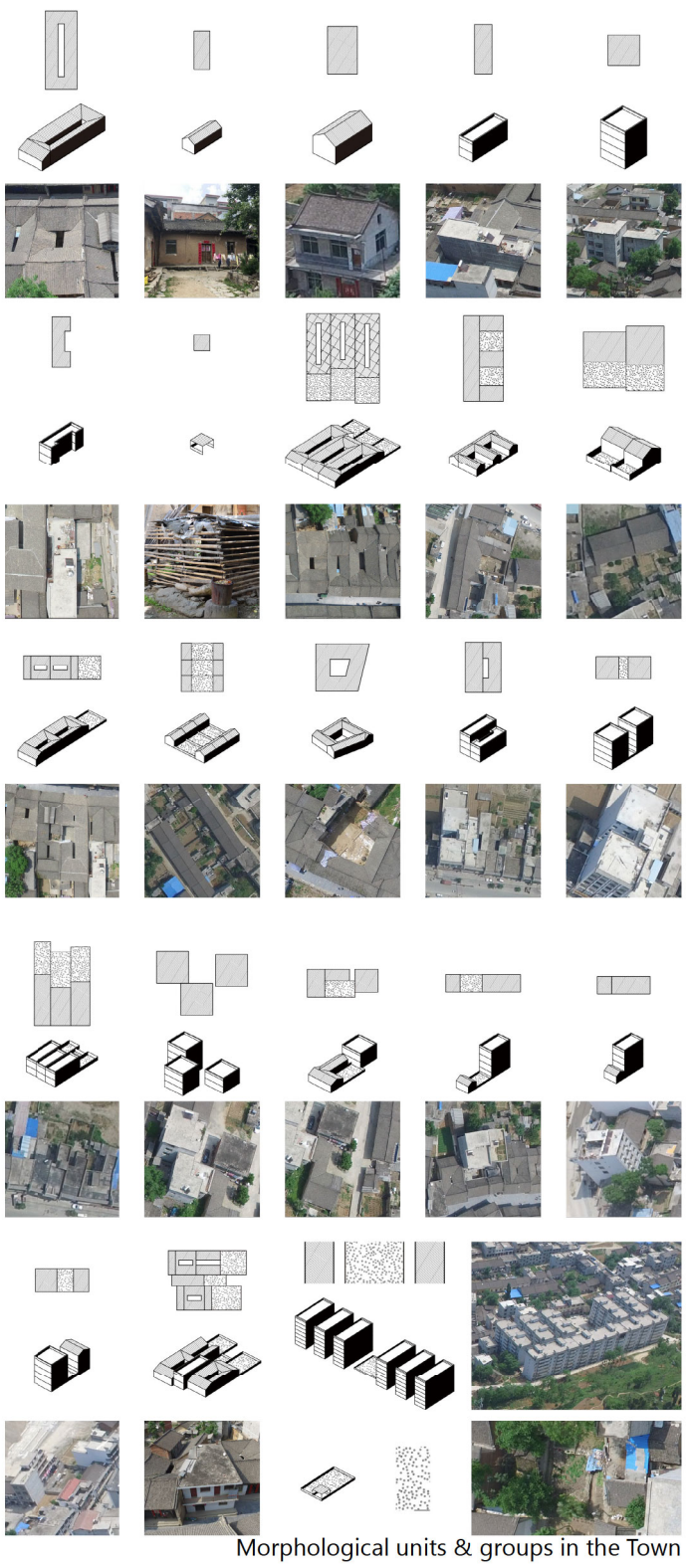
Fish-bone morphological pattern of the Old Street



Radial fan-shape of the Town (Source Pezzetti, 2019)



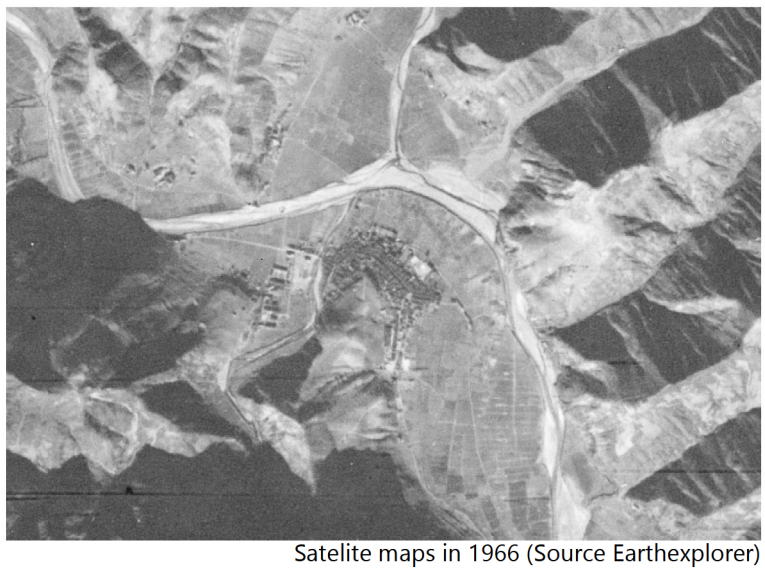
Devastation of the environment



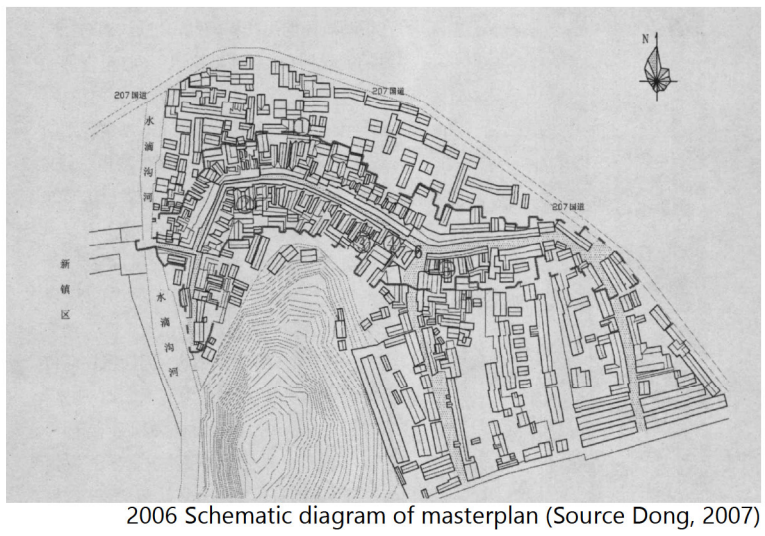
Morphological units & groups in the Town

Hand-painted panorama in 1957 (Source Gao, 2008)

Panoramic photo in 1958 (Fenghuang Tourist Committee, 2012)



Satelite maps in 1966 (Source Earthexplorer)



2006 Schematic diagram of masterplan (Source Dong, 2007)

Goole satellite image in 2013

Goole satellite image in 2018

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ARCHITECTURE DESIGN STUDIO
D-A.A.2018/19

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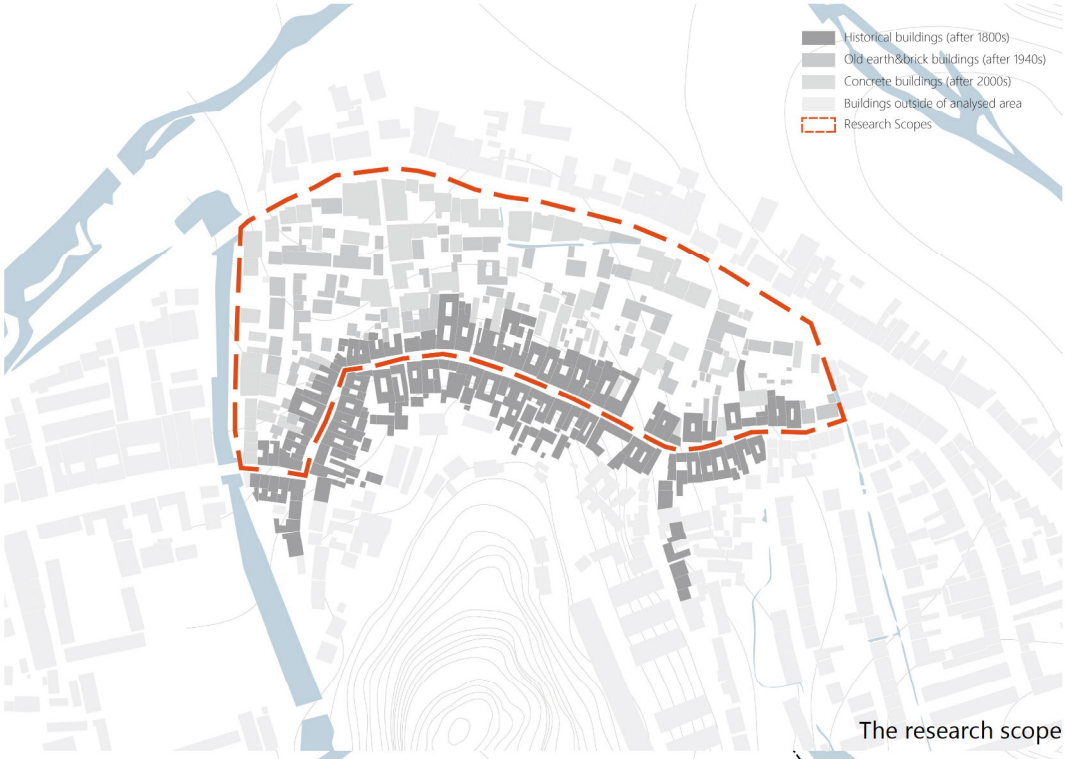
STUDENT:
XIONG ZESONG

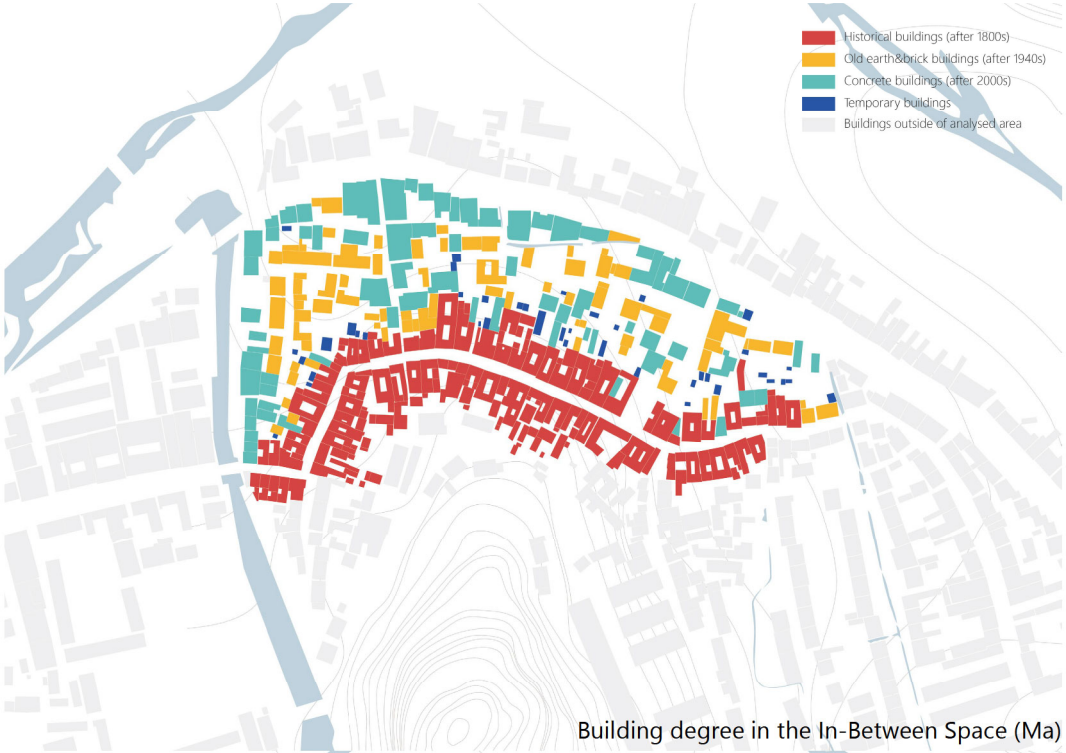
Rewriting the Palimpsest of Fenghuang Town between the Old and New

Morphological characteristics of the Fenghuang Town

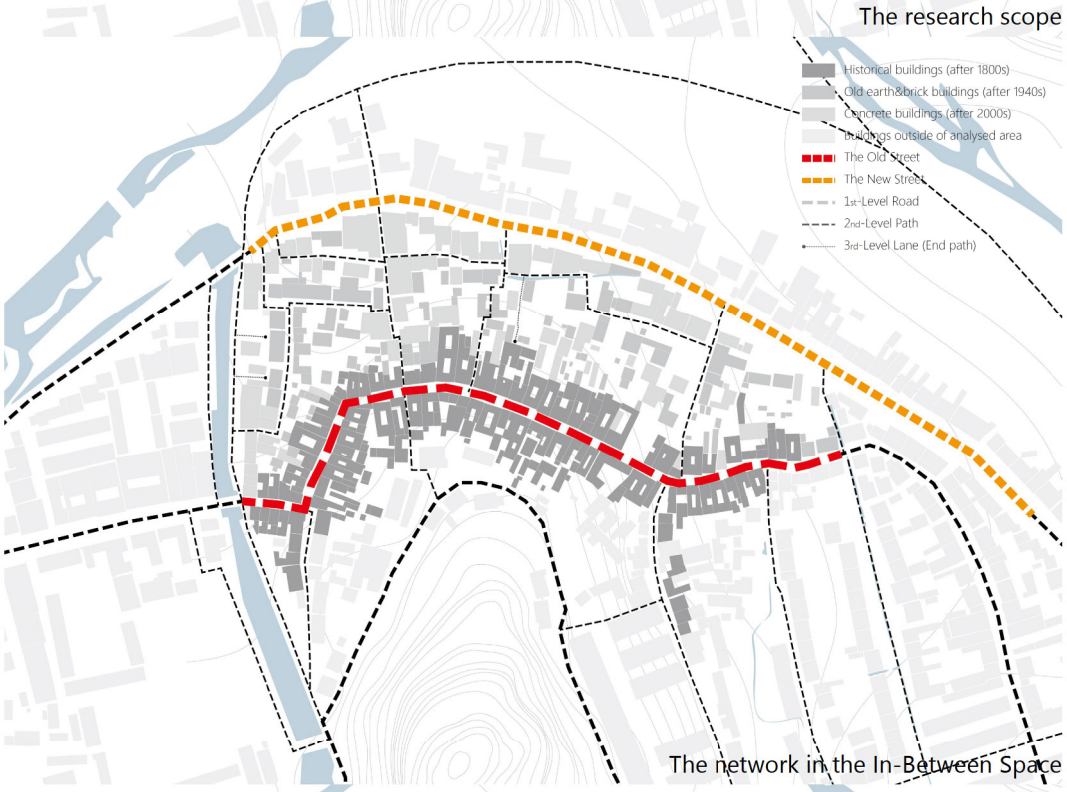
02



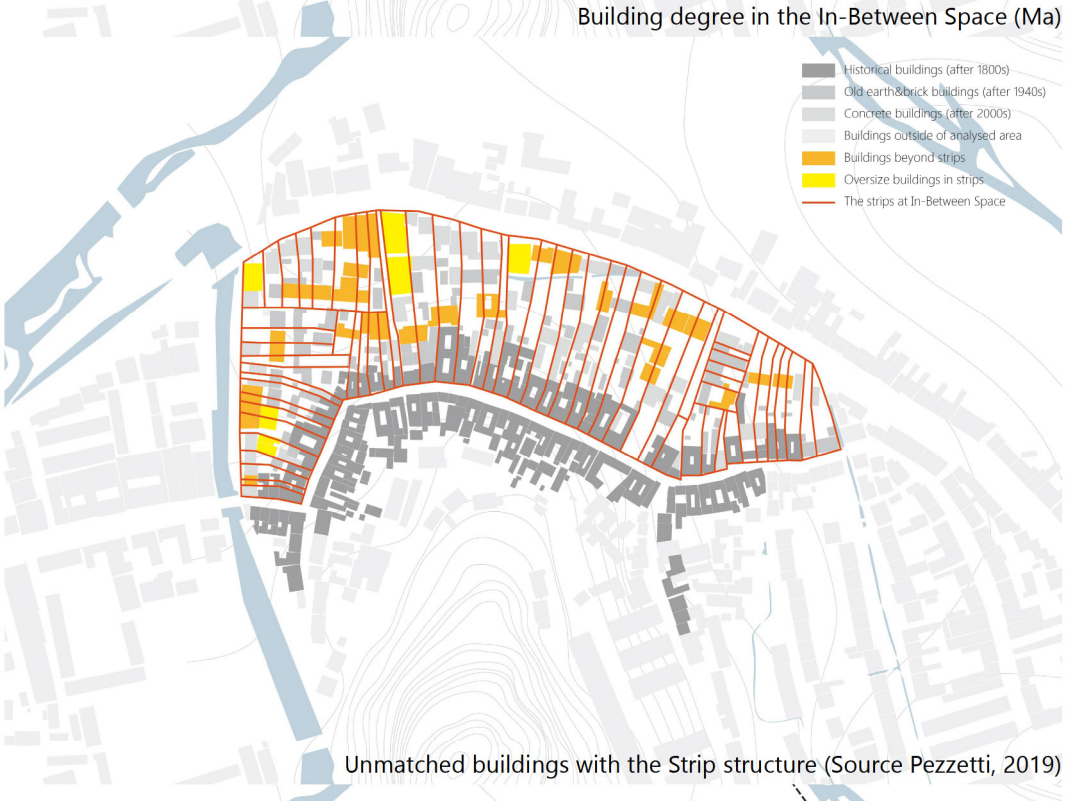
The research scope



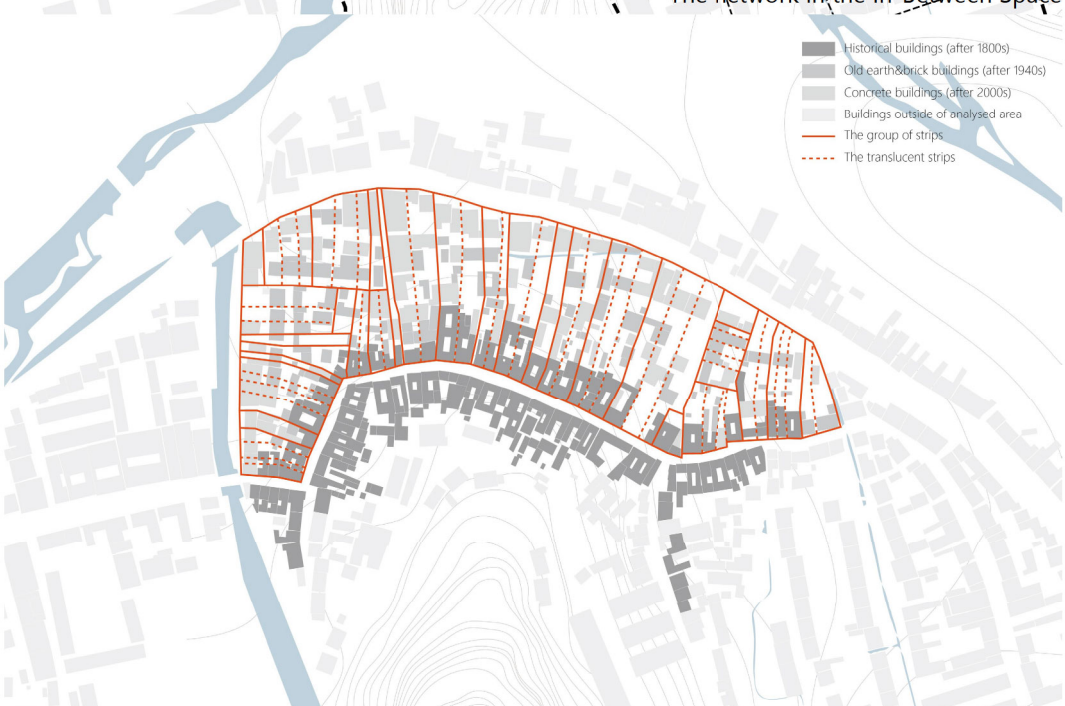
Building degree in the In-Between Space (Ma)



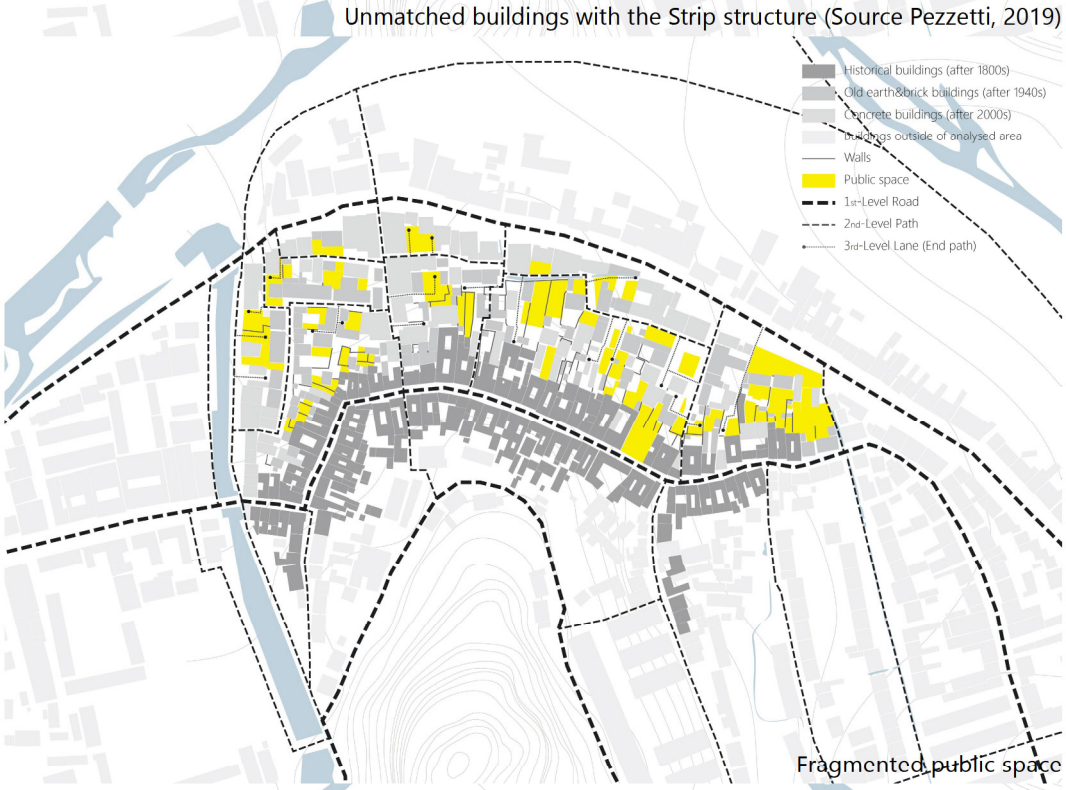
The network in the In-Between Space



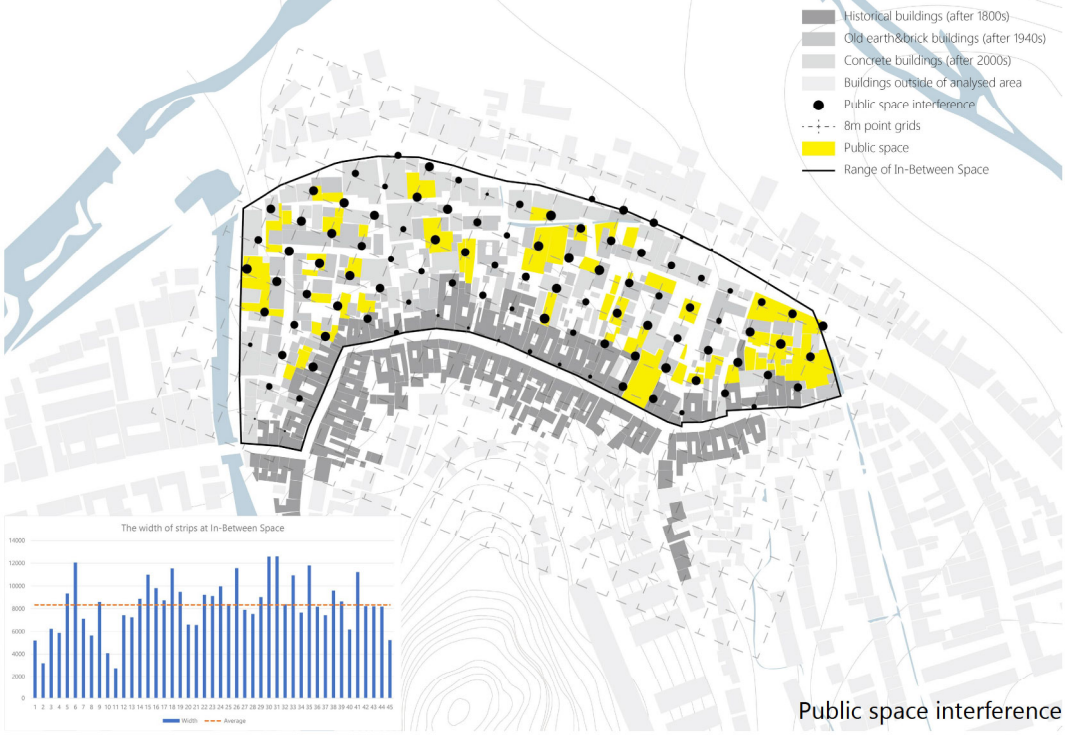
Unmatched buildings with the Strip structure (Source Pezzetti, 2019)



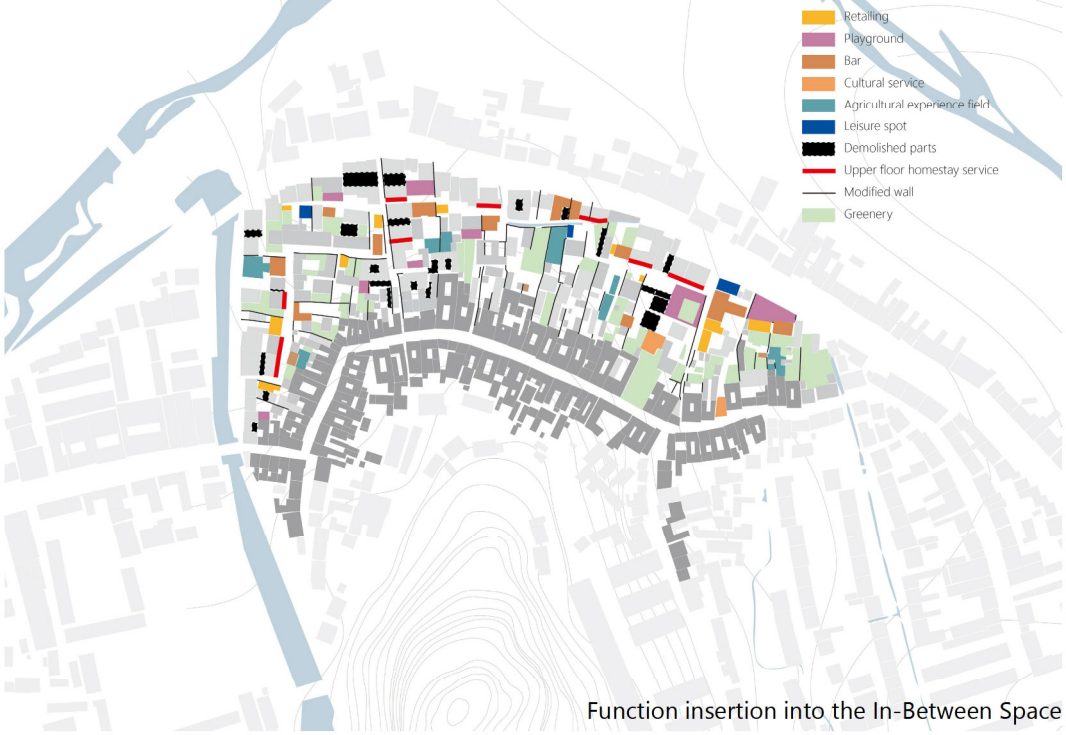
New Strip structure in the In-Between Space (Source Pezzetti, 2019)



Fragmented public space



Public space interference



Function insertion into the In-Between Space

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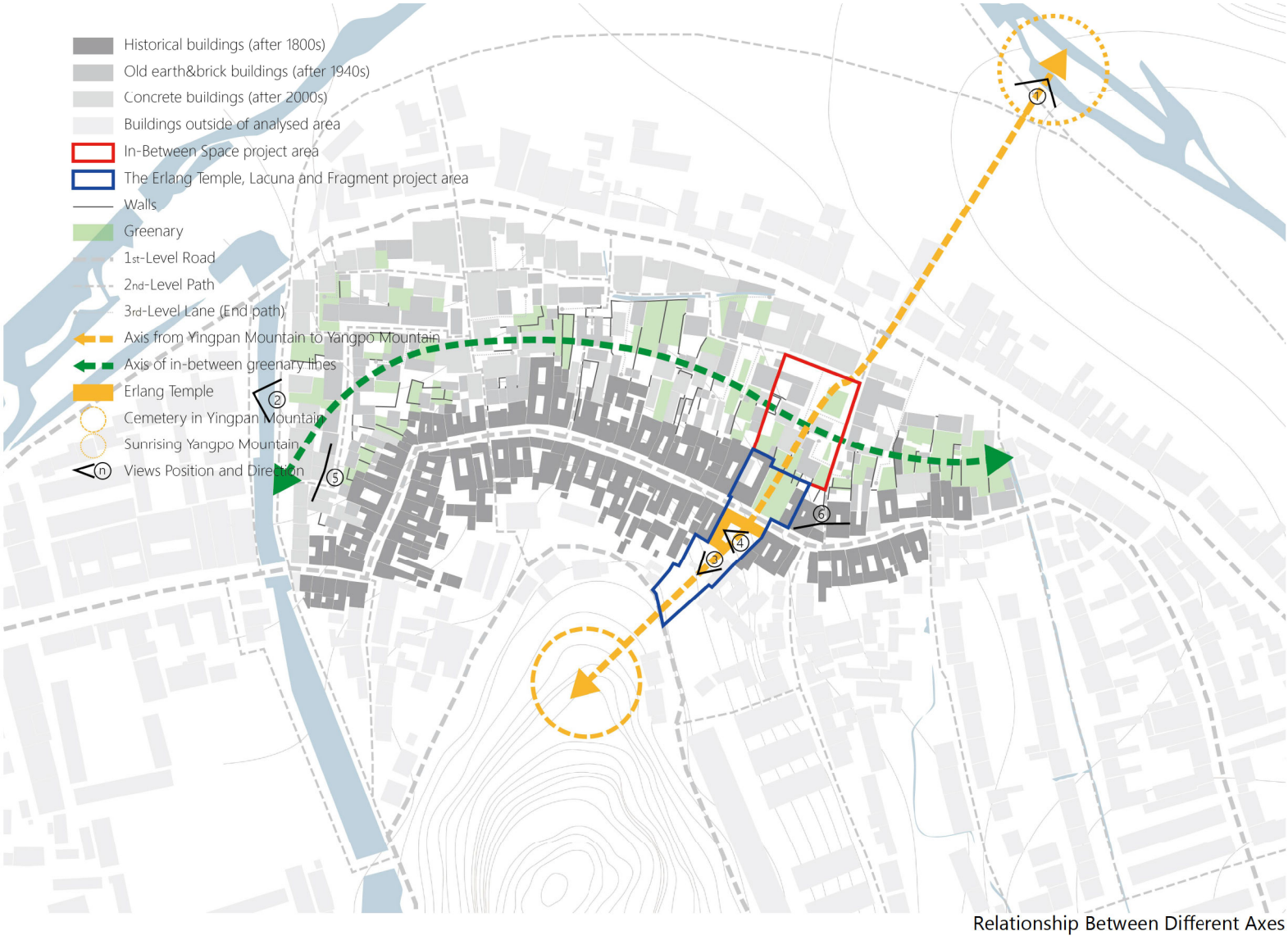
Rewriting the Palimpsest of Fenghuang Town between the Old and New

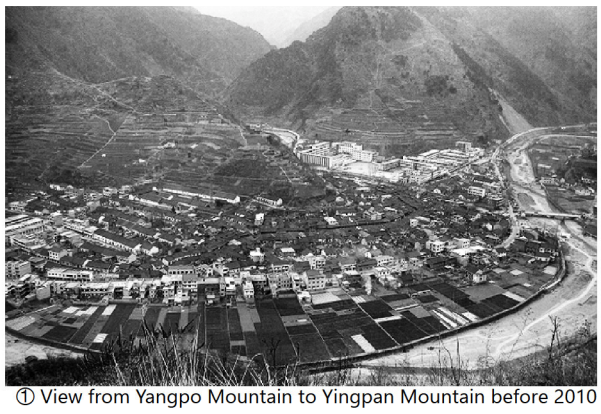
DIAGRAM OF IN-BETWEEN SPACE

Palimpsest of In-Between Space in project area

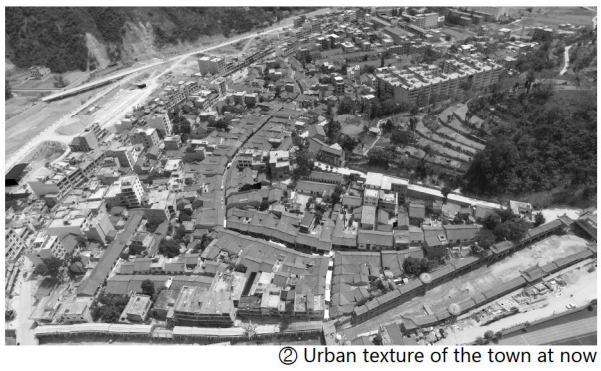
03



Relationship Between Different Axes

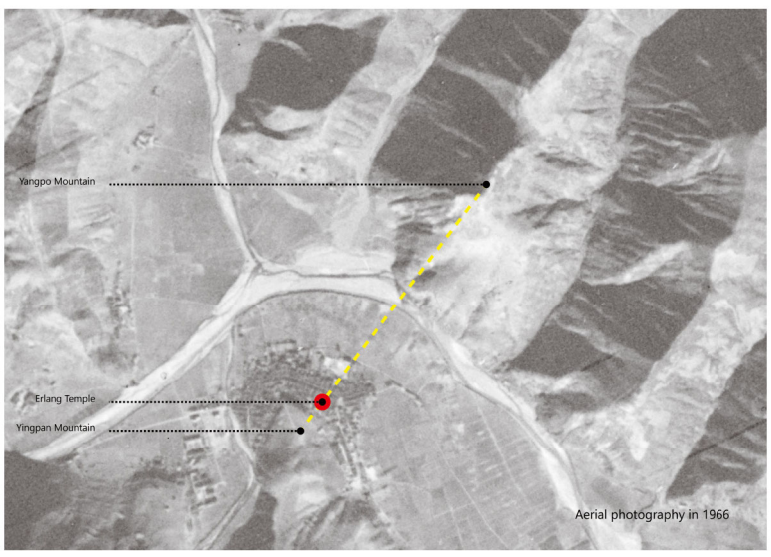


① View from Yangpo Mountain to Yingpan Mountain before 2010



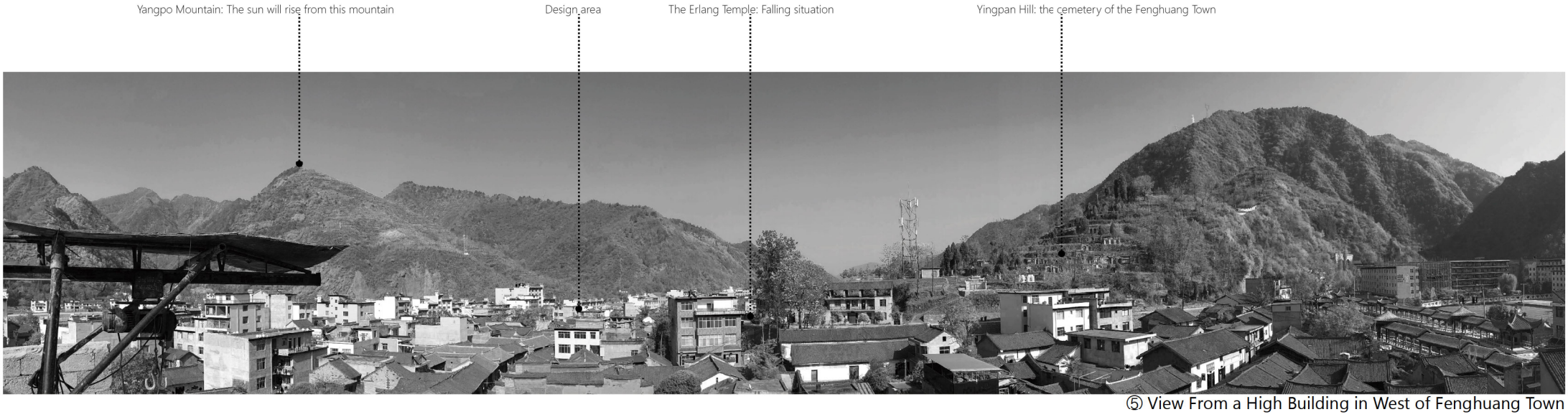
② Urban texture of the town at now

③ Falling of the temple

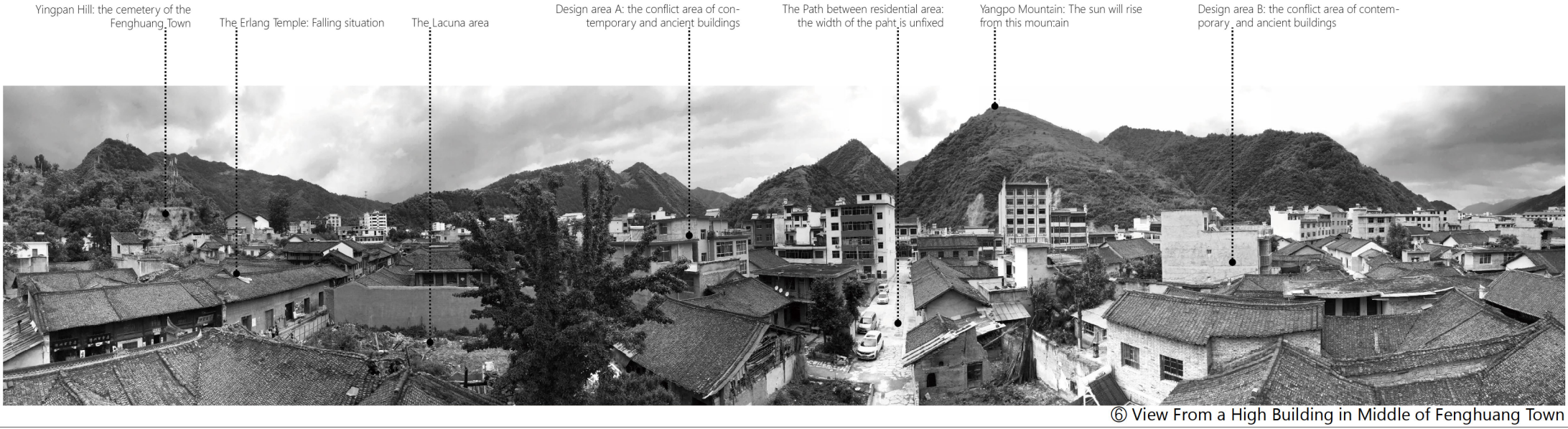


Relationship Between Different Axes

④ Falling of the temple



⑤ View From a High Building in West of Fenghuang Town



⑥ View From a High Building in Middle of Fenghuang Town

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STUDENT:
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Rewriting the Palimpsest of Fenghuang Town between the Old and New

Rewriting the Cultural Axis

Plan of Present Situation
Materials

Plan of Present Situation
Function

Plan of Present Situation
Floors

Plan of Present Situation
Greenery

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MILANO 1863

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Rewriting the Palimpsest of Fenghuang Town between the Old and New

Plan-Fundamental features of project area

Transformation in the Cultural Axis

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

Plan of Present Situation

01. Rural Homestay
02. Hiking Trail
03. Corridor in Backyard
04. Tearoom & Meeting
05. Exhibition of Wallruins
06. Erlang Temple Museum
07. Meeting Room
08. Exhibition of Ancient Temple
09. Courtyard of Erlang Temple
10. Leisure Square
11. Cafe & Library
12. Retails Hall
13. Exhibition of Old Crafts
14. Urban Memory Museum
15. Foreyard of Urban Temple
16. Urban Temple
17. Stage for Traditional Activities
18. Backyard of Urban Temple

Project Plan

POLITECNICO MILANO 1863

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D-A.A.2018/19

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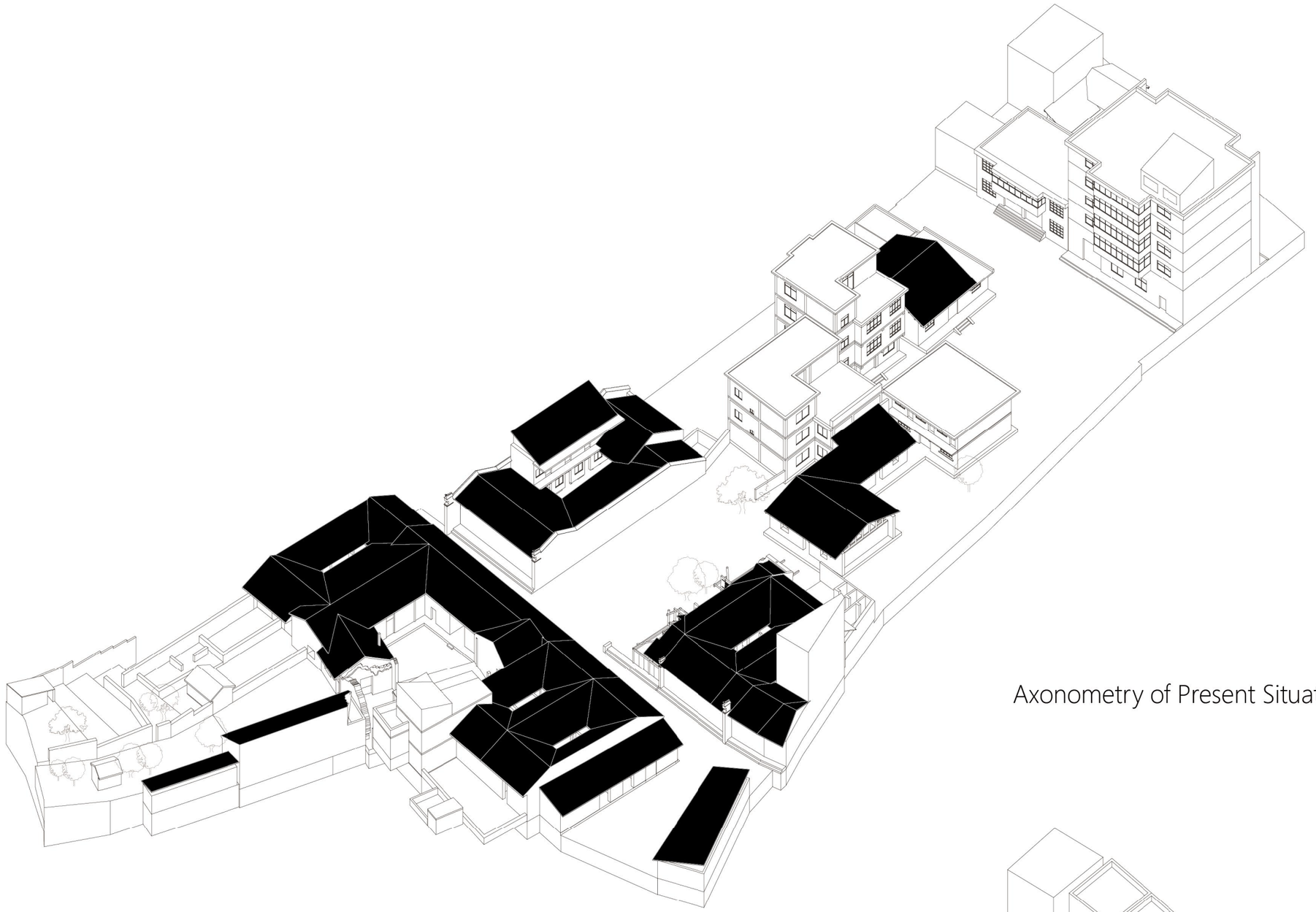
Rewriting the Palimpsest of Fenghuang Town between the Old and New

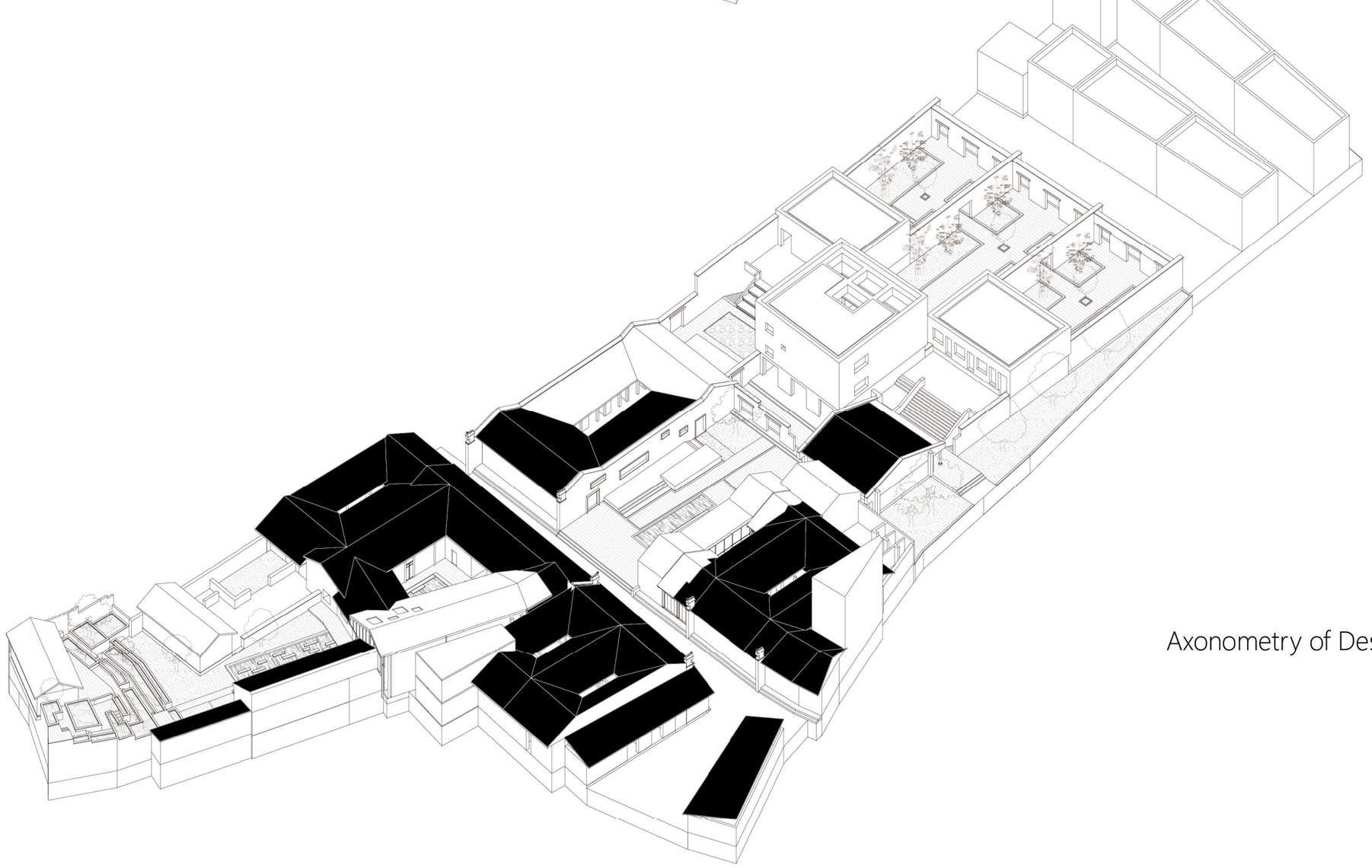
DESIGN OF GROUND FLOOR IN IN-BETWEEN AREA

Transformation in the Cultural Axis

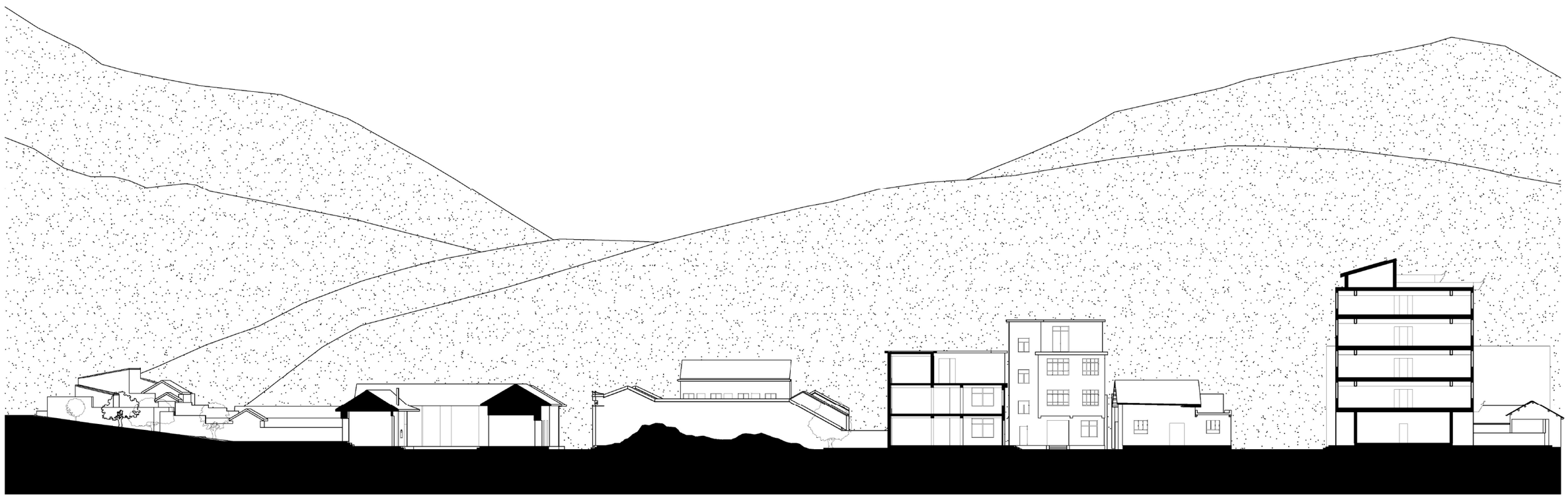
Plan about Demolished & Design



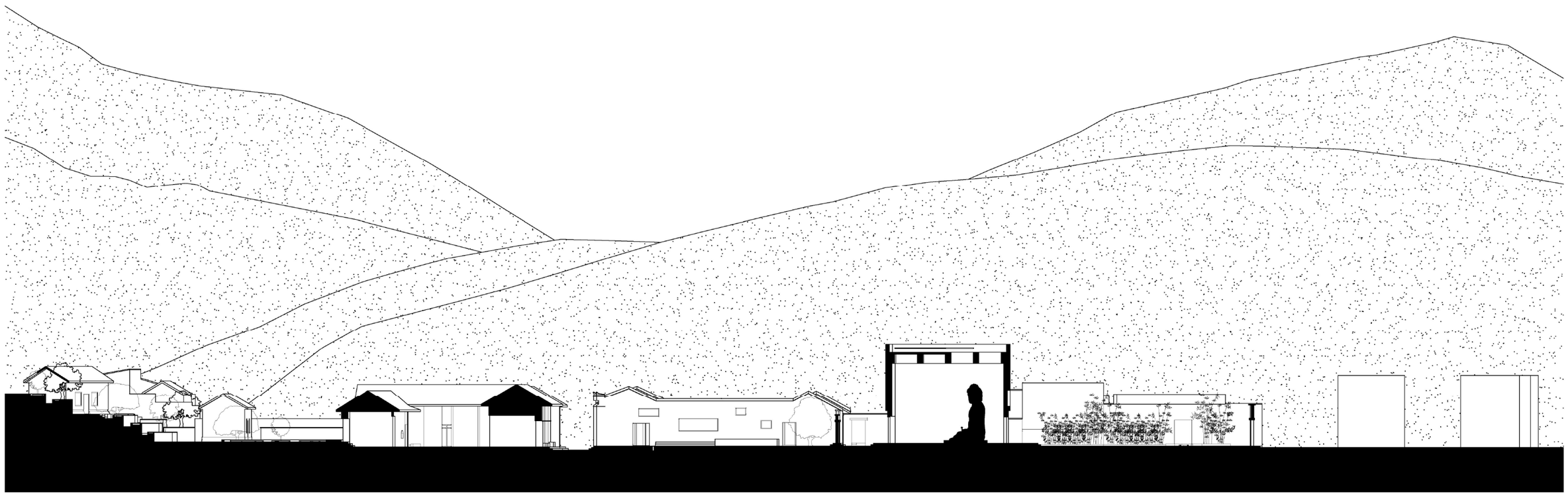
Axonometry of Present Situation



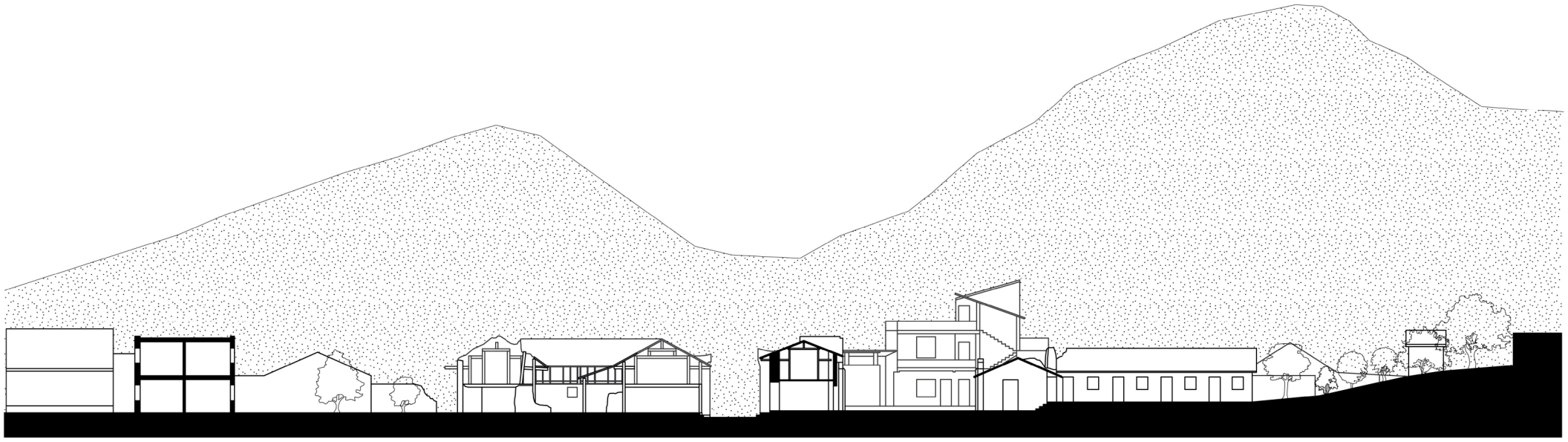
Axonometry of Design



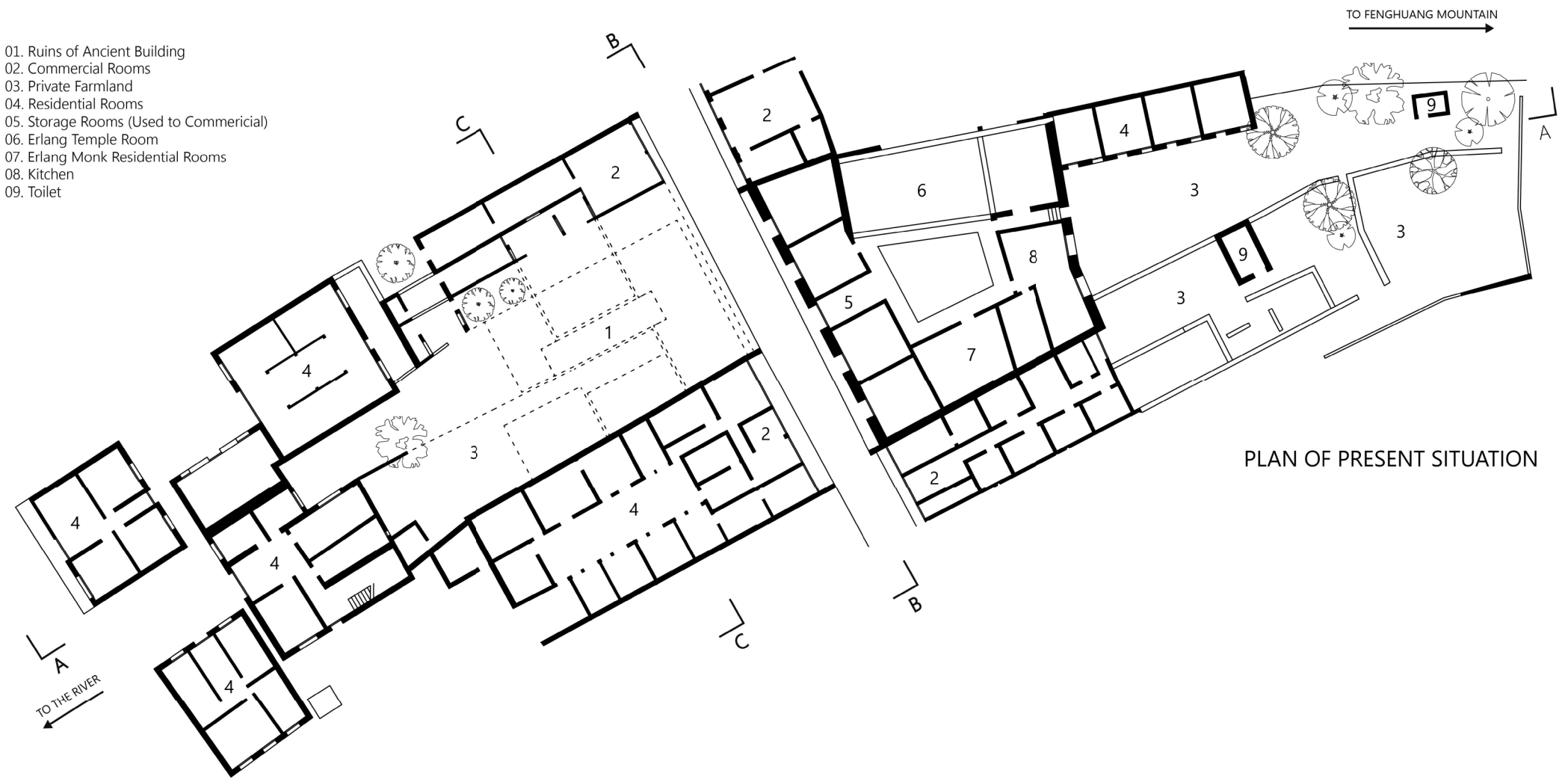
A-A Section of Present Situation



A-A Section of Design

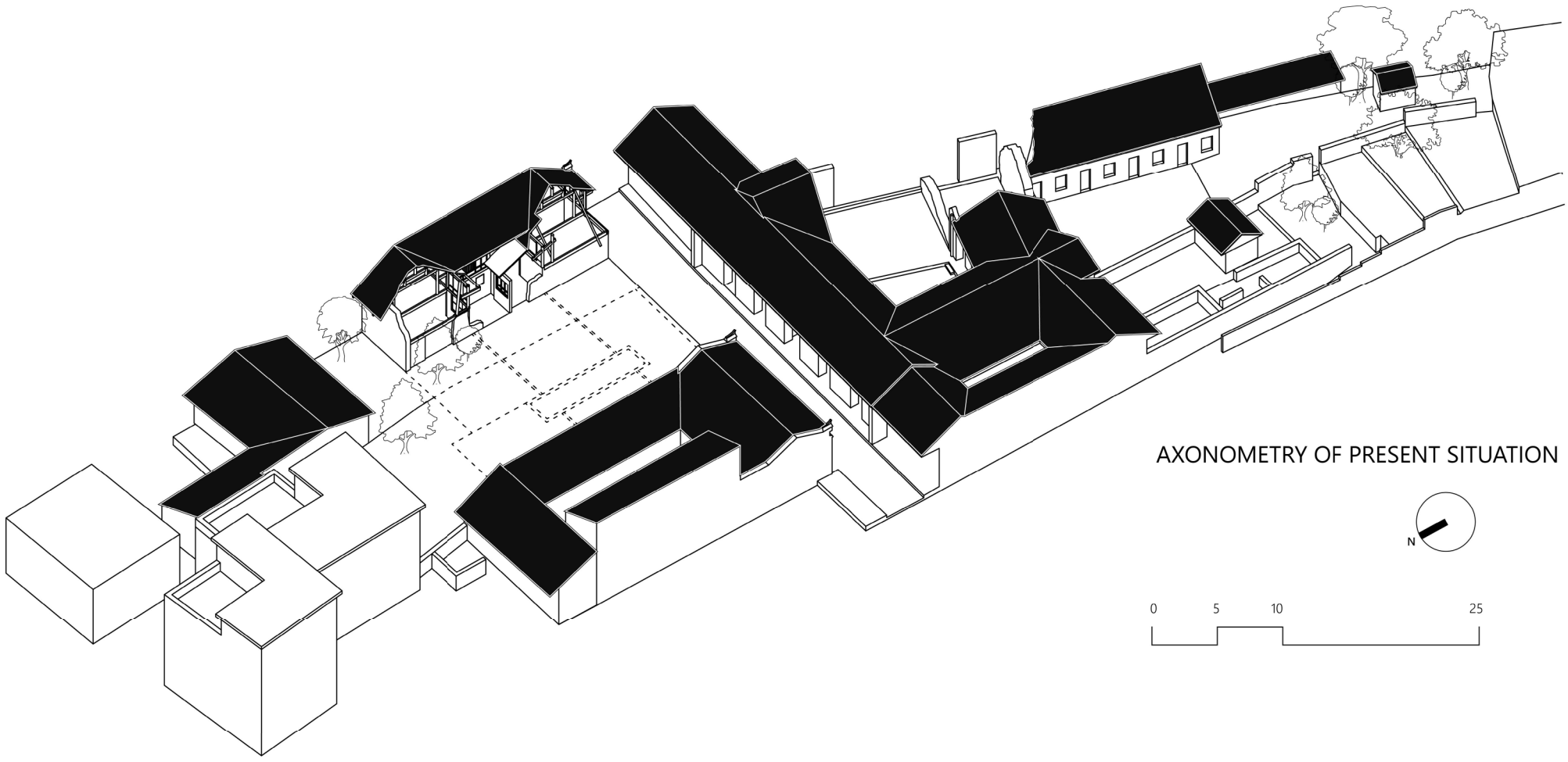


A-A SECTION OF PRESENT SITUATION



01. Ruins of Ancient Building
02. Commercial Rooms
03. Private Farmland
04. Residential Rooms
05. Storage Rooms (Used to Commericial)
06. Erlang Temple Room
07. Erlang Monk Residential Rooms
08. Kitchen
09. Toilet

PLAN OF PRESENT SITUATION



AXONOMETRY OF PRESENT SITUATION

N

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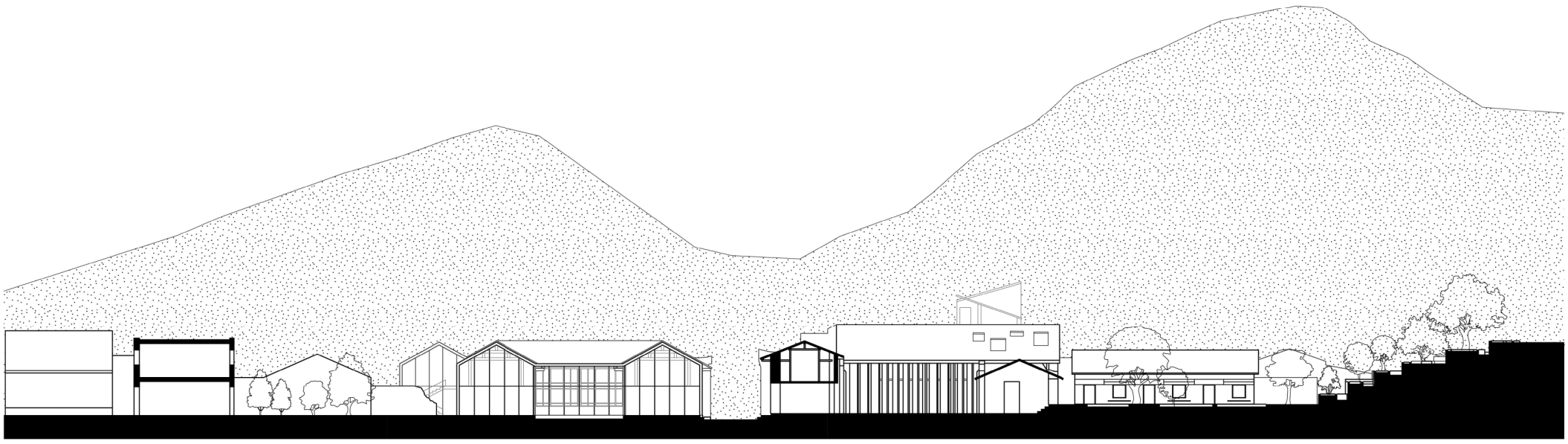
Rewriting the Palimpsest of Fenghuang Town between the Old and New

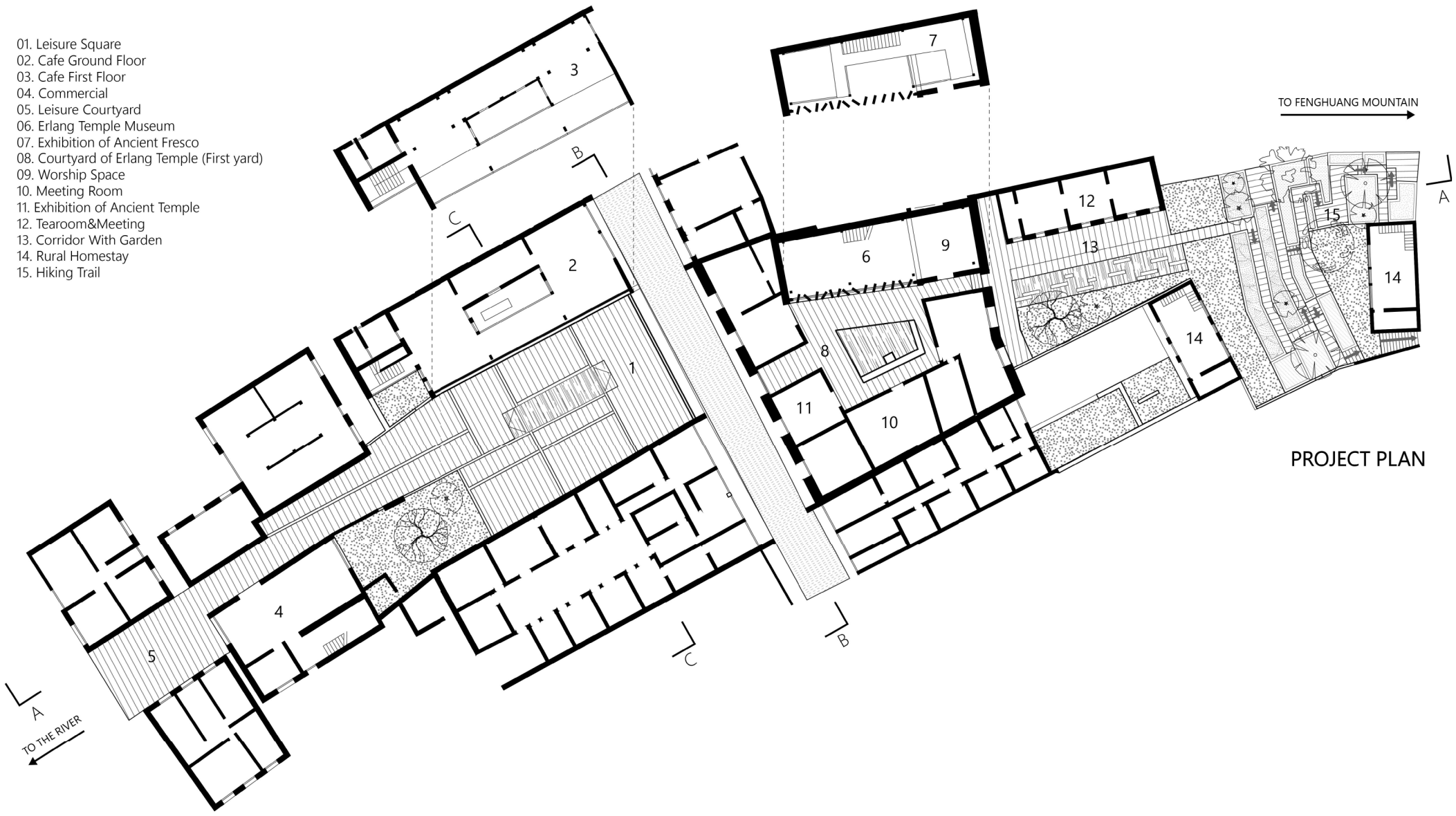
STATE OF ART IN ERLANG TEMPLE AND LACUNA AREA

Rewriting the Erlang Temple and Lacuna Area

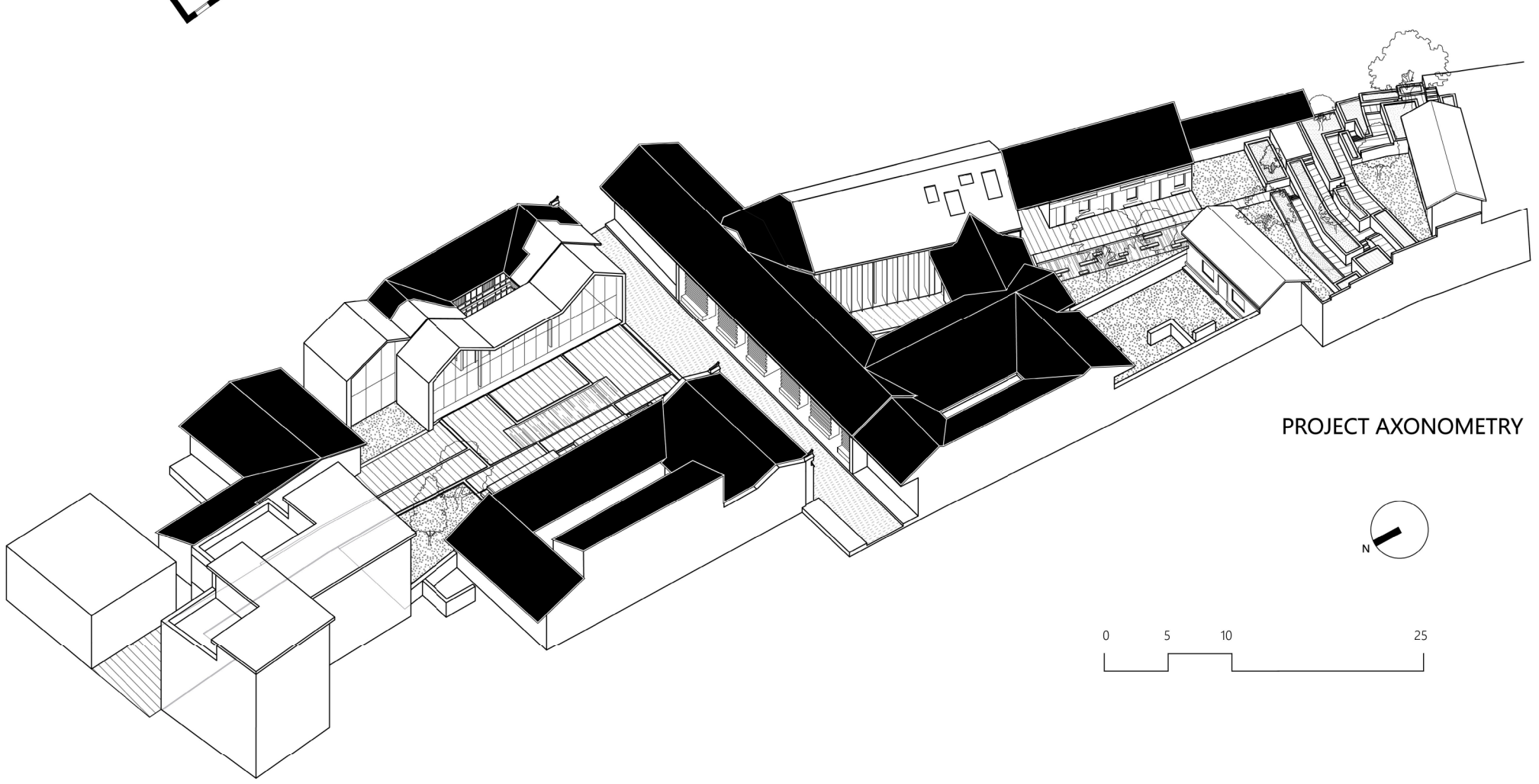


PROJECT SECTION A-A

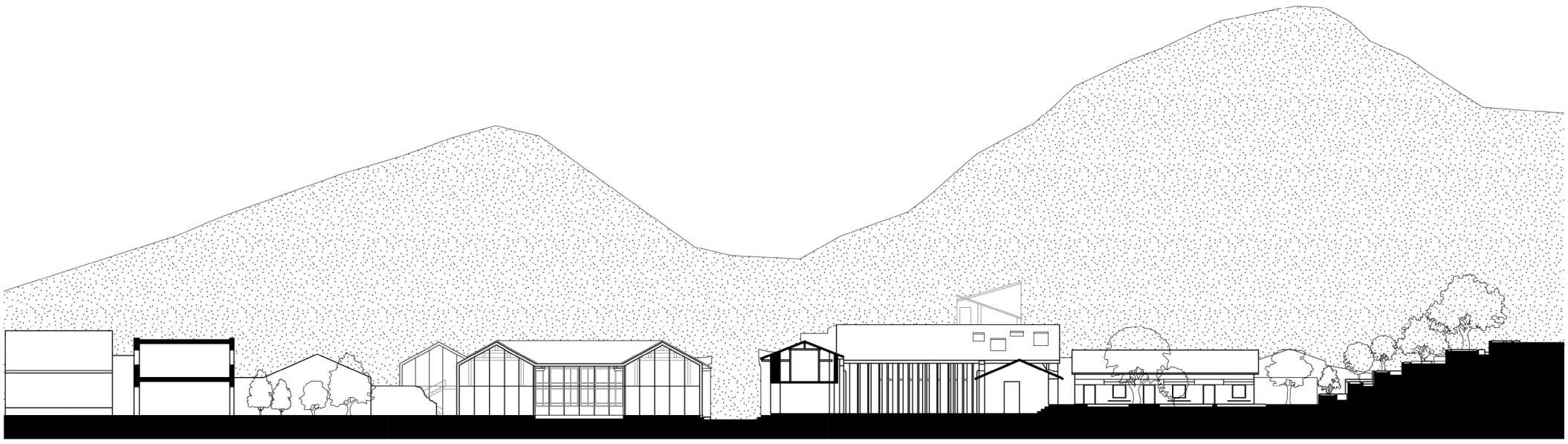
01. Leisure Square
02. Cafe Ground Floor
03. Cafe First Floor
04. Commercial
05. Leisure Courtyard
06. Erlang Temple Museum
07. Exhibition of Ancient Fresco
08. Courtyard of Erlang Temple (First yard)
09. Worship Space
10. Meeting Room
11. Exhibition of Ancient Temple
12. Tearoom&Meeting
13. Corridor With Garden
14. Rural Homestay
15. Hiking Trail



PROJECT PLAN



PROJECT AXONOMETRY



PROJECT SECTION A-A

01. Leisure Square
02. Cafe Ground Floor
03. Cafe First Floor
04. Commercial
05. Leisure Courtyard
06. Erlang Temple Museum
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09. Worship Space
10. Meeting Room
11. Exhibition of Ancient Temple
12. Tearoom&Meeting
13. Corridor With Garden
14. Rural Homestay
15. Hiking Trail

TO FENGHUANG MOUNTAIN

TO THE RIVER

PROJECT PLAN

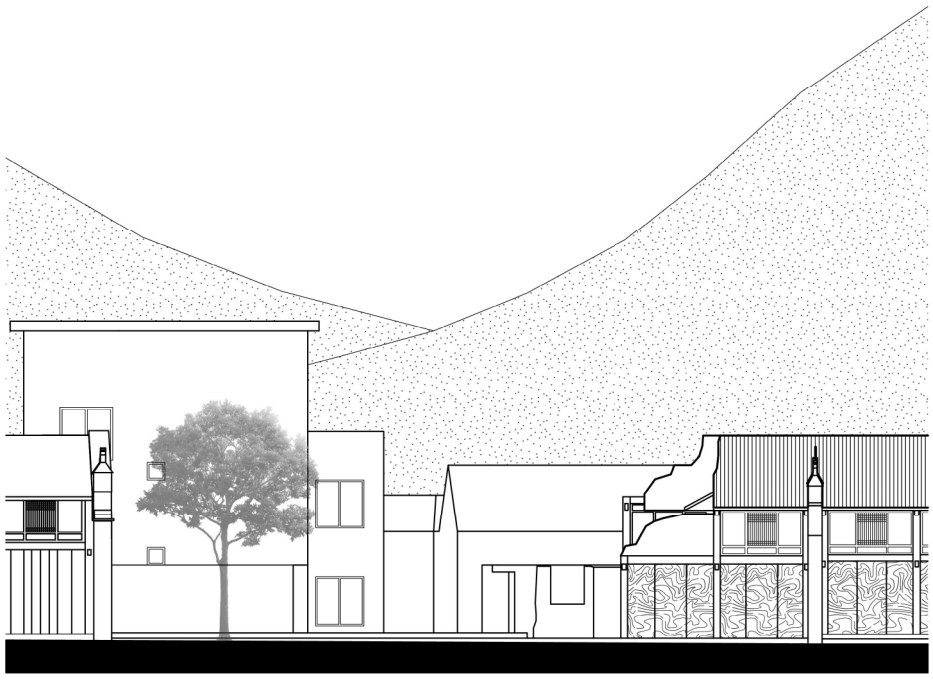
PROJECT AXONOMETRY

Volumes addition

Volumes addition

N

0 5 10 25



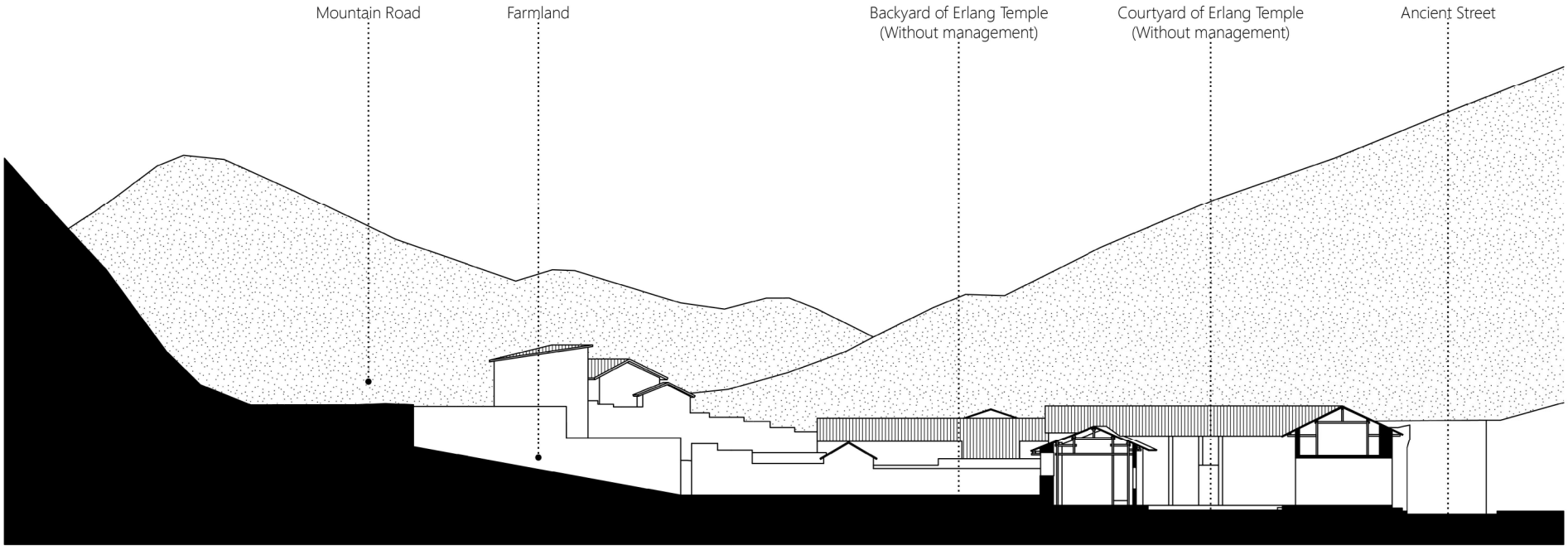
B-B SECTION OF PRESENT SITUATION

PROJECT B-B SECTION

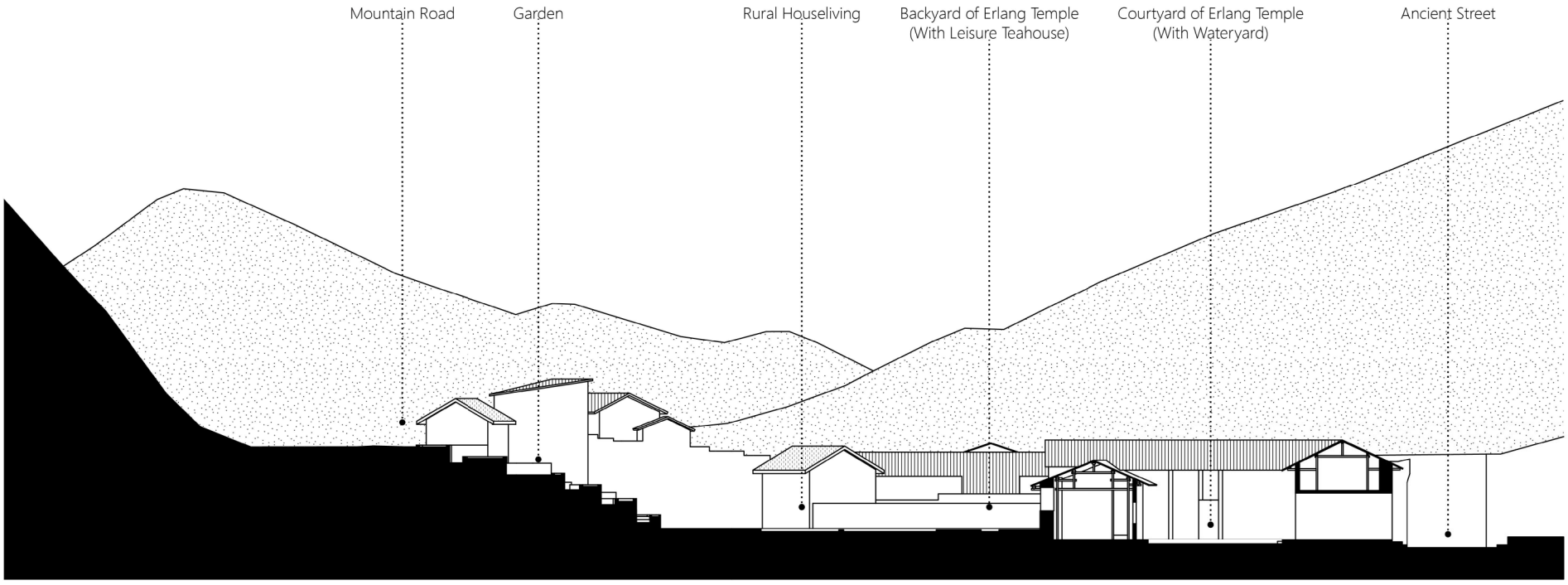
C-C SECTION OF PRESENT SITUATION

PROJECT C-C SECTION

PROJECT PERSPECTIVE IN RUINS



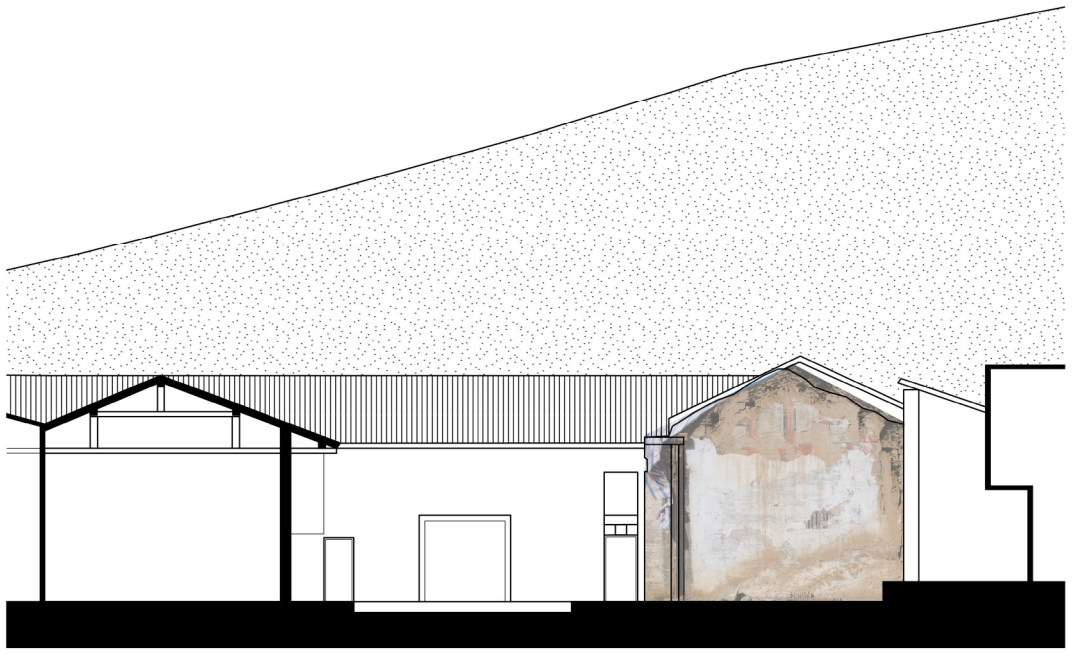
PRESENT SECTION OF ERLANG TEMPLE



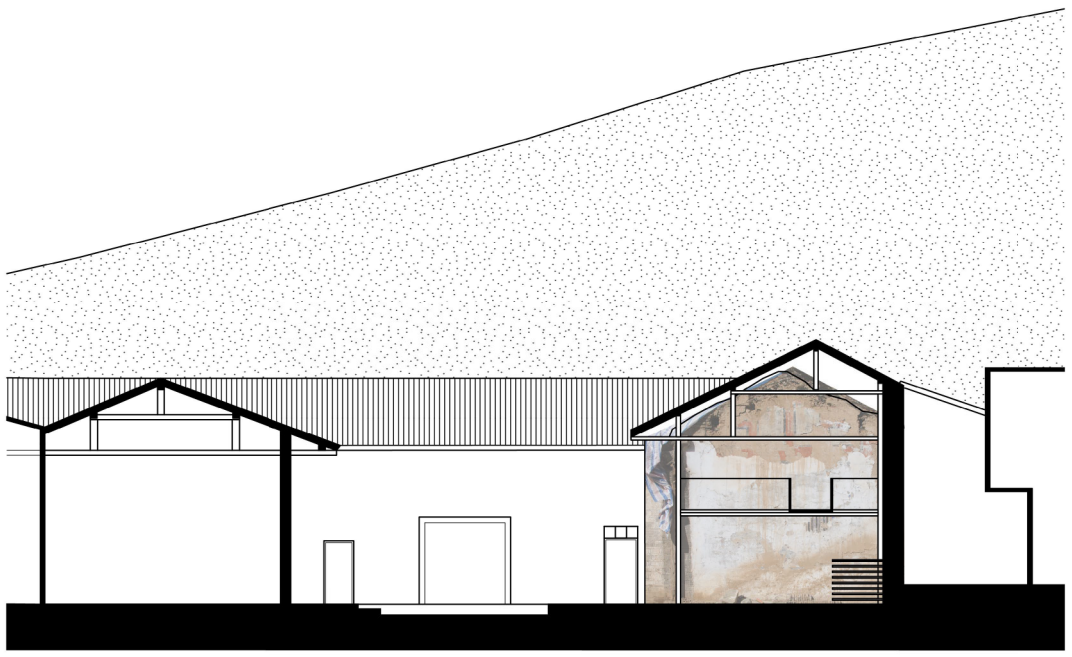
PROJECT SECTION OF ERLANG TEMPLE

PROJECT PERSPECTIVE IN BACKYARD OF ERLANG TEMPLE

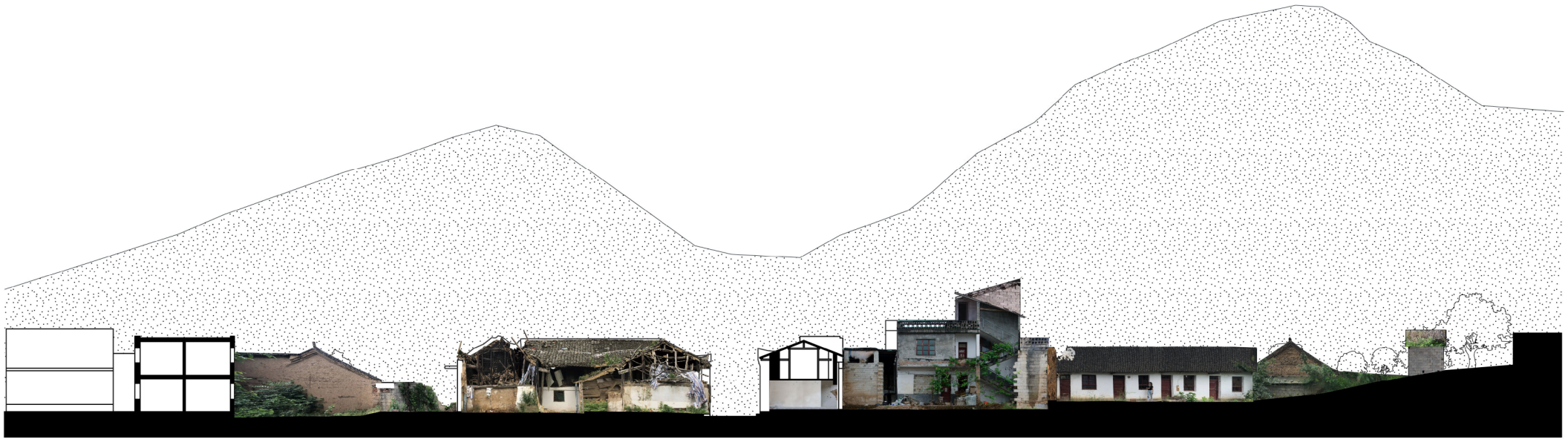
PRESENT INSIDE SECTION OF ERLANG TEMPLE



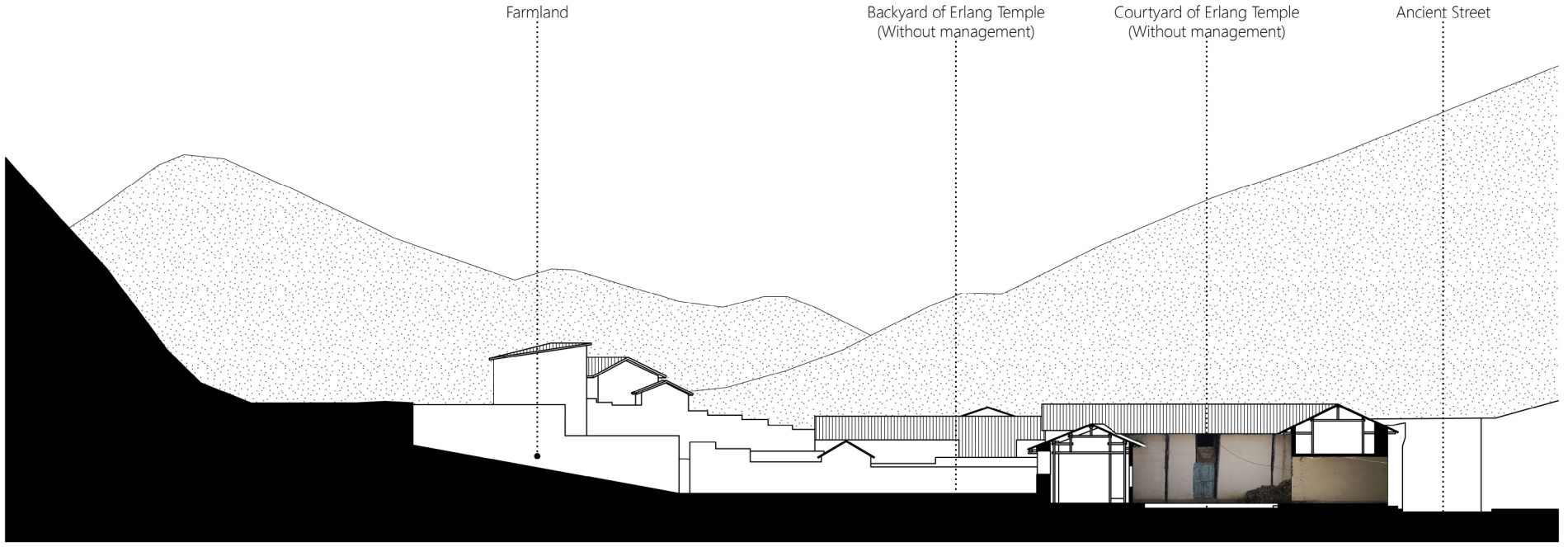
PROJECT INSIDE SECTION OF ERLANG TEMPLE



PROJECT PERSPECTIVE IN COURTYARD OF ERLANG TEMPLE

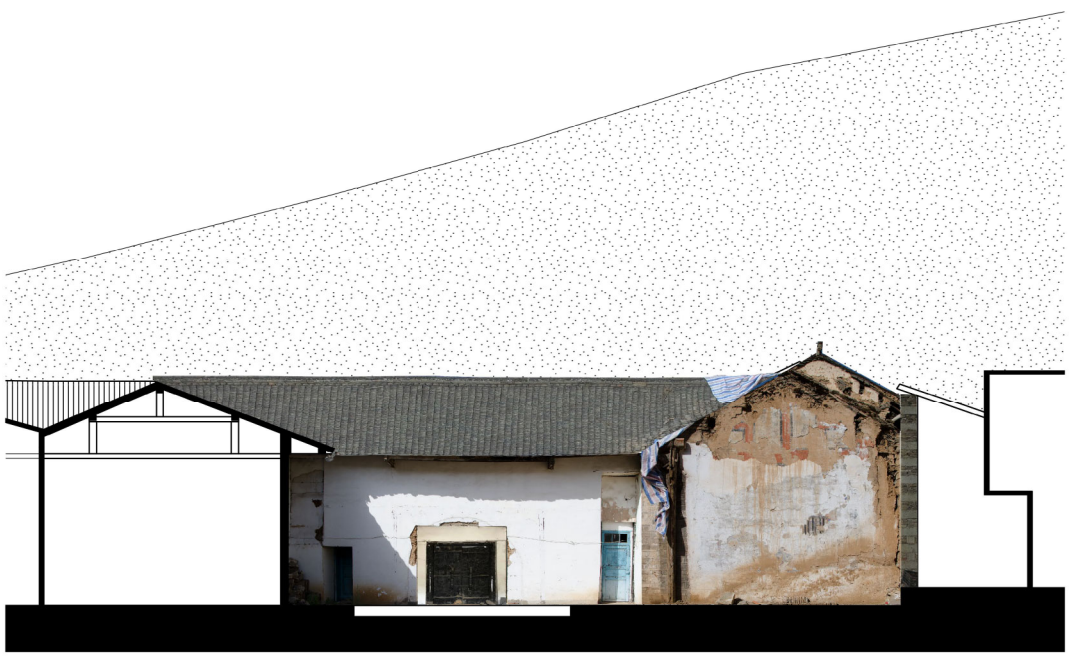


A-A SECTION OF PRESENT SITUATION

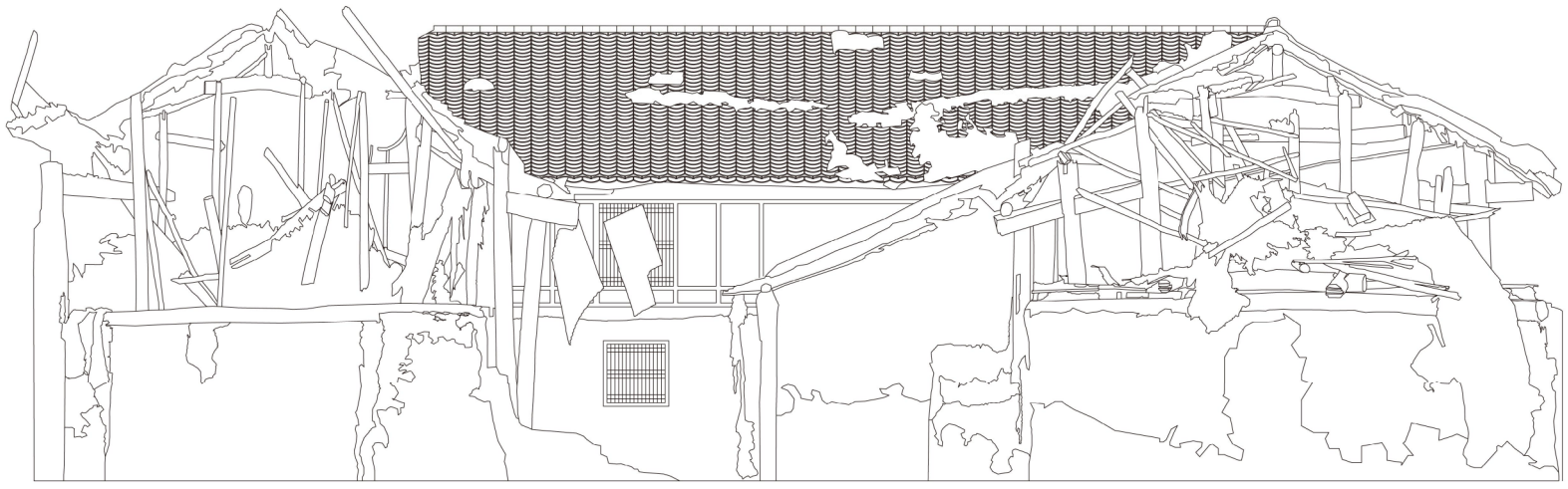


D-D PRESENT SECTION OF ERLANG TEMPLE

B-B SECTION OF PRESENT SITUATION



E-E PRESENT INSIDE SECTION OF ERLANG TEMPLE



PRESENT SITUATION OF RUINS IN LINE DRAFT

PRESENT SITUATION OF RUINS IN PICTURE

Material

- Wood
- Plaster
- Earth
- Plastic
- Clay
- Plant

Architectural Elements & Materials

Architectural Elements & Materials

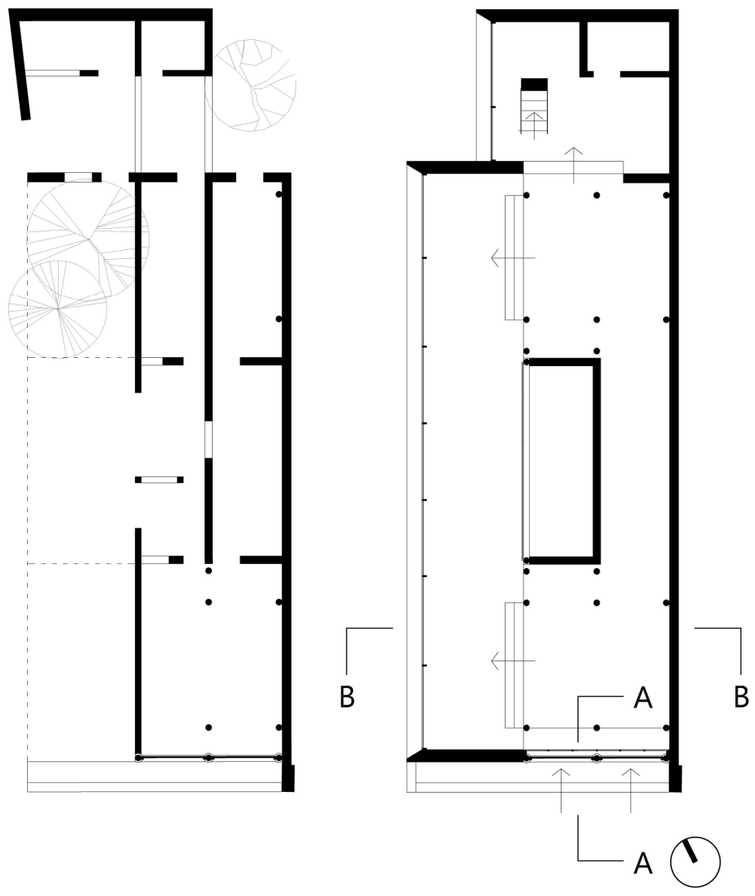
- Pillars
- Timbers
- Tiles
- Mud with Straw
- Adobes
- Beams
- White Plaster
- Transparent Tiles
- Vegetation
- Others

Deterioration

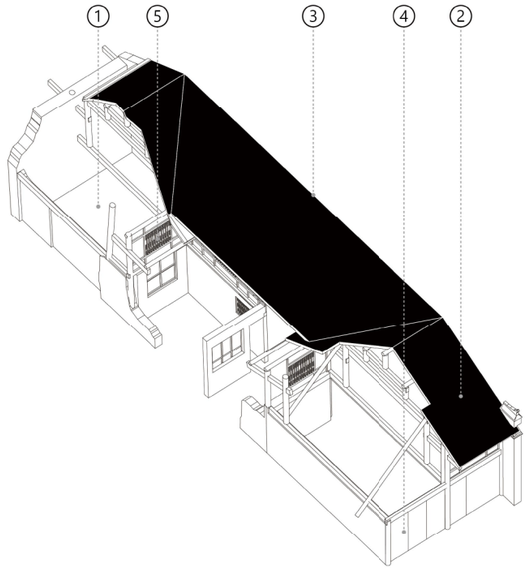
- Hair Crack
- Erosion
- Fracture
- Delamination
- Damage
- Biological Colonization

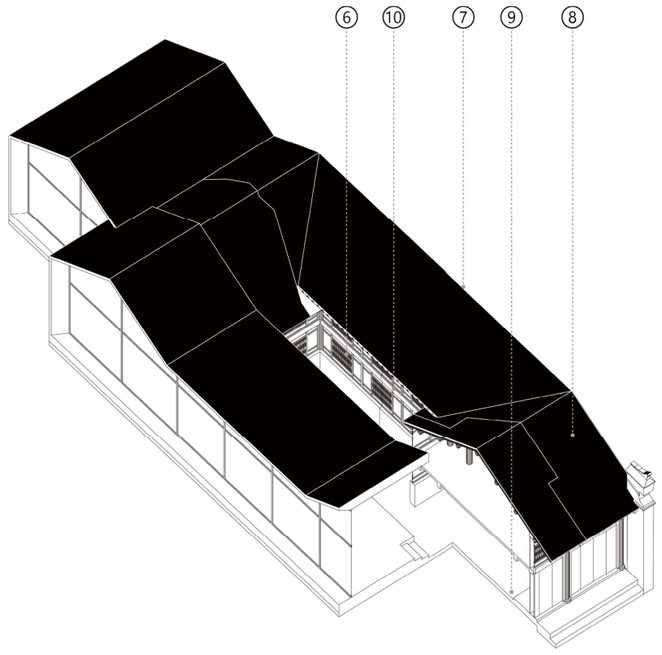
Wall	Original-Adobe Wall	Design-Adobe Wall	Original-Wood Wall	Design-Wood Wall(windows)
Materials	20mm cement plaster 200mm adobe 20mm cement plaster	20mm cement plaster 100mm EPS 250mm adobe 20mm cement plaster	30mm timber	30mm timber 120mm EPS 30mm timber
U-Value(W/m²K)	2.63	0.29	2.63	0.26
Windows	**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	10mm timber	0.84	0.74	0.62
visible transmittance		0.89	0.83	0.73
website		https://www.nationalglass.com.au/products/duo-plus/	https://www.nationalglass.com.au/products/energy-efficient-glass-lowerclear/	https://www.nationalglass.com.au/products/energy-efficient-glass-loweclear/
U-Value(W/m²K)	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/m²K)	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/m²K)	0.73			

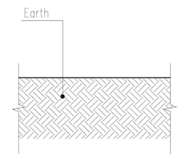
U-Value of details between old and design in Fragment



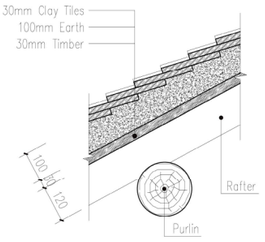
Fragment ground plan between old and deisgn 1:100



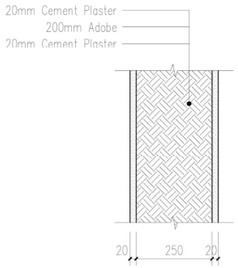




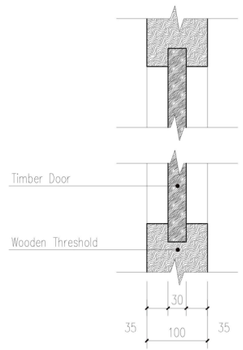
① Original Ground Floor 1:10



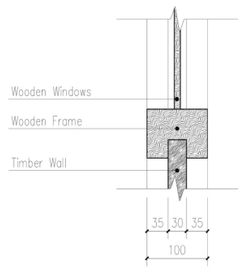
② Original Tile Roof 1:10



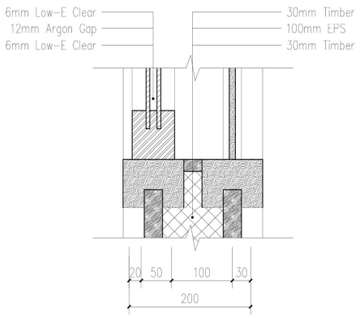
③ Original Adobe Wall 1:10



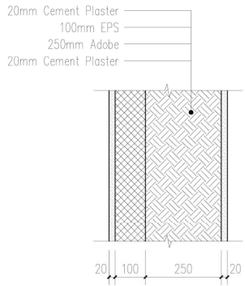
④ Original Wood Wall 1:5



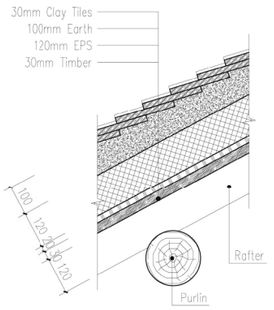
⑤ Original Wood Windows 1:5



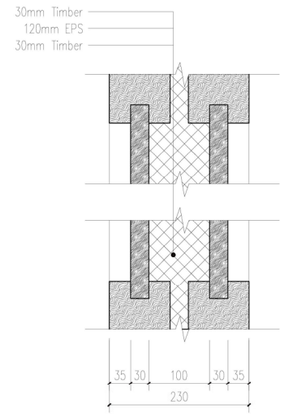
⑥ Design Wood Windows 1:5



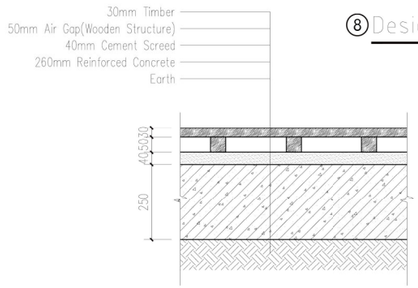
⑦ Design Adobe Wall 1:10



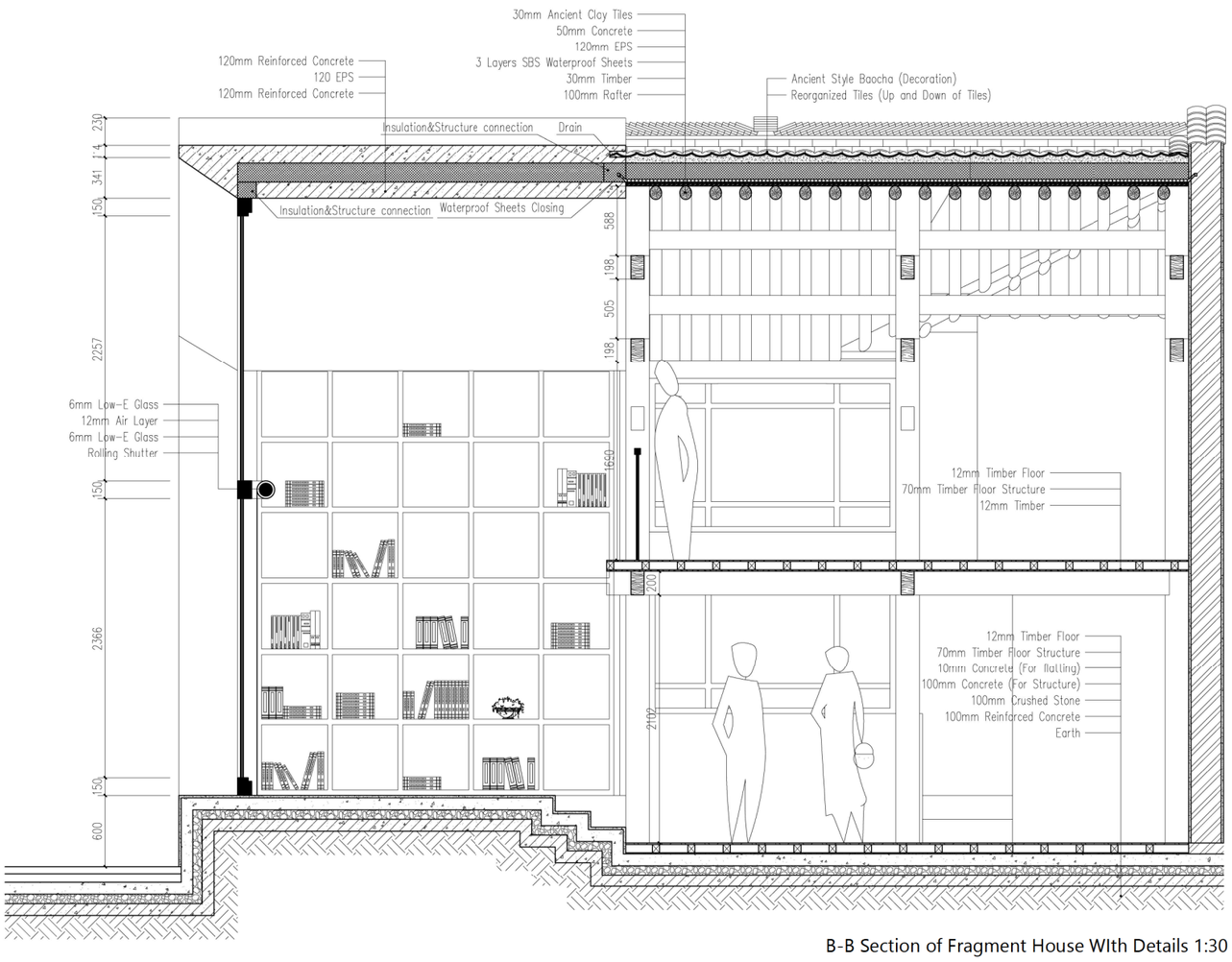
⑧ Design Tile Roof 1:10



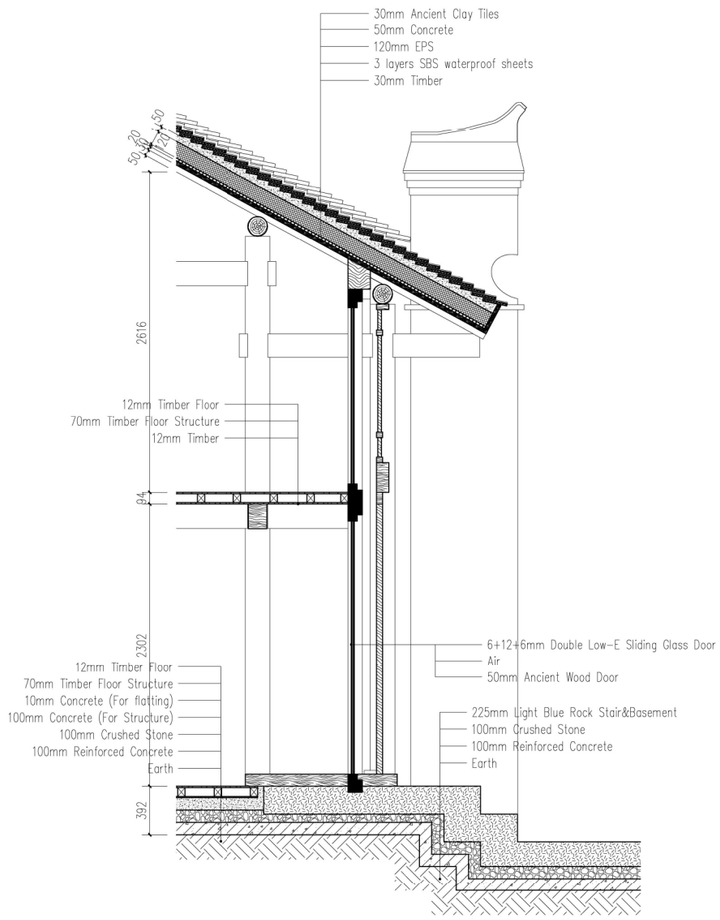
⑩ Design Wood Wall 1:5



⑨ Design Ground Floor 1:10



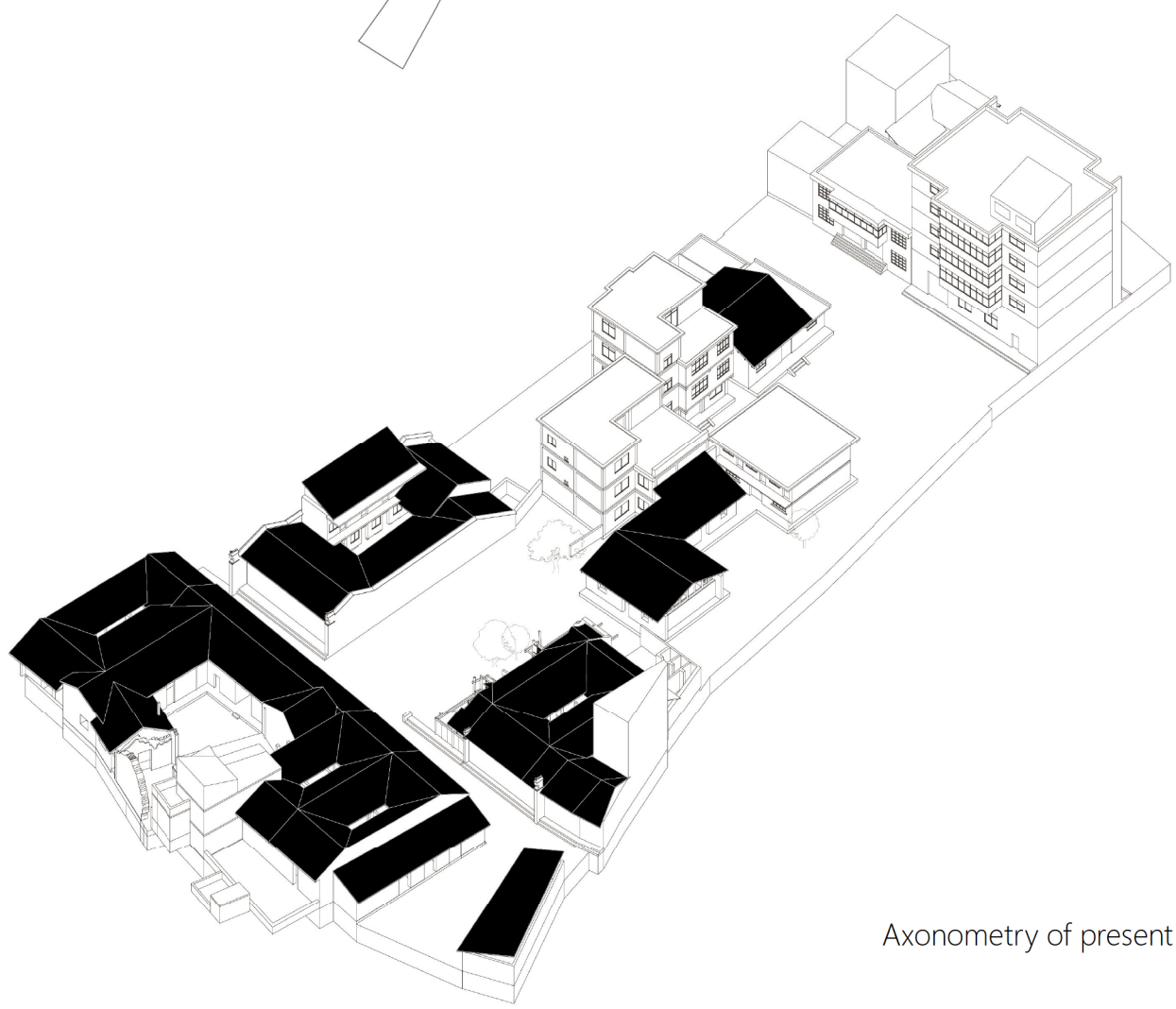
B-B Section of Fragment House WIth Details 1:30



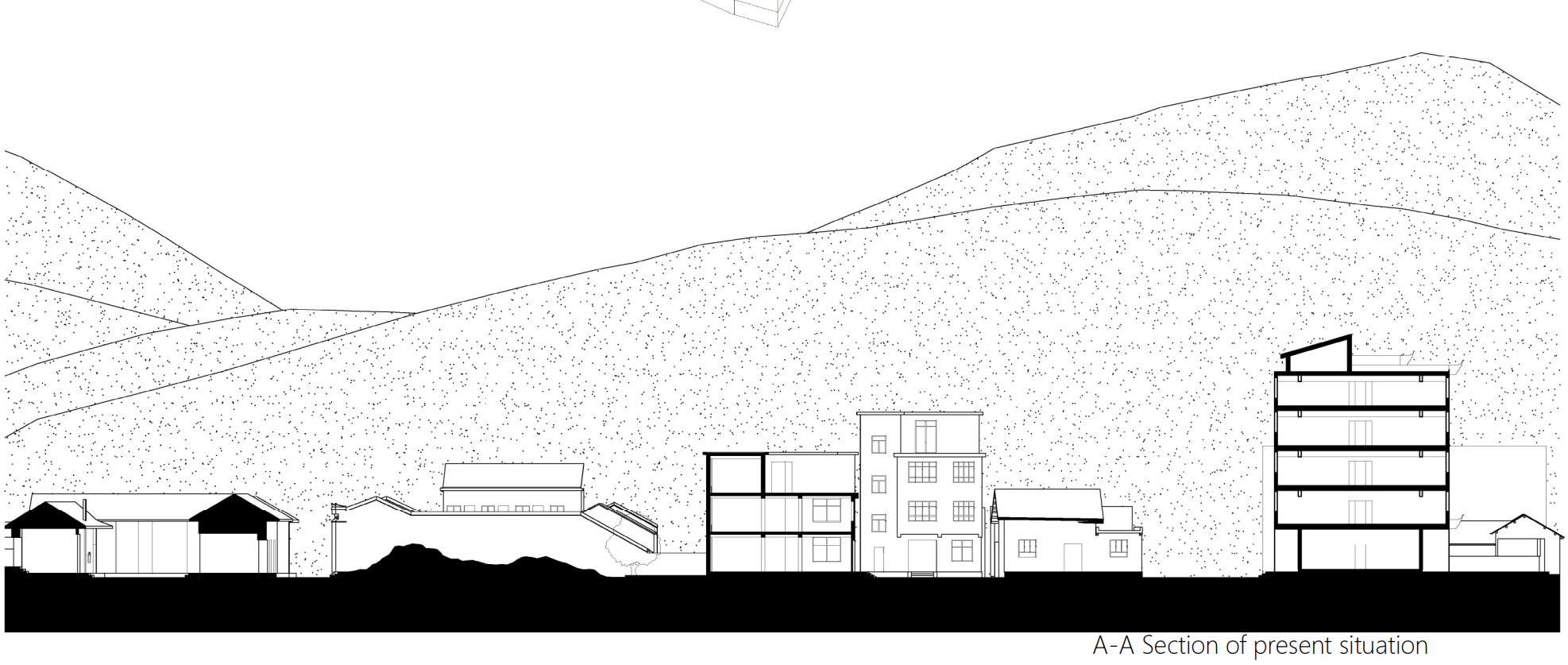
A-A Section of Fragment House WIth Details 1:30

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

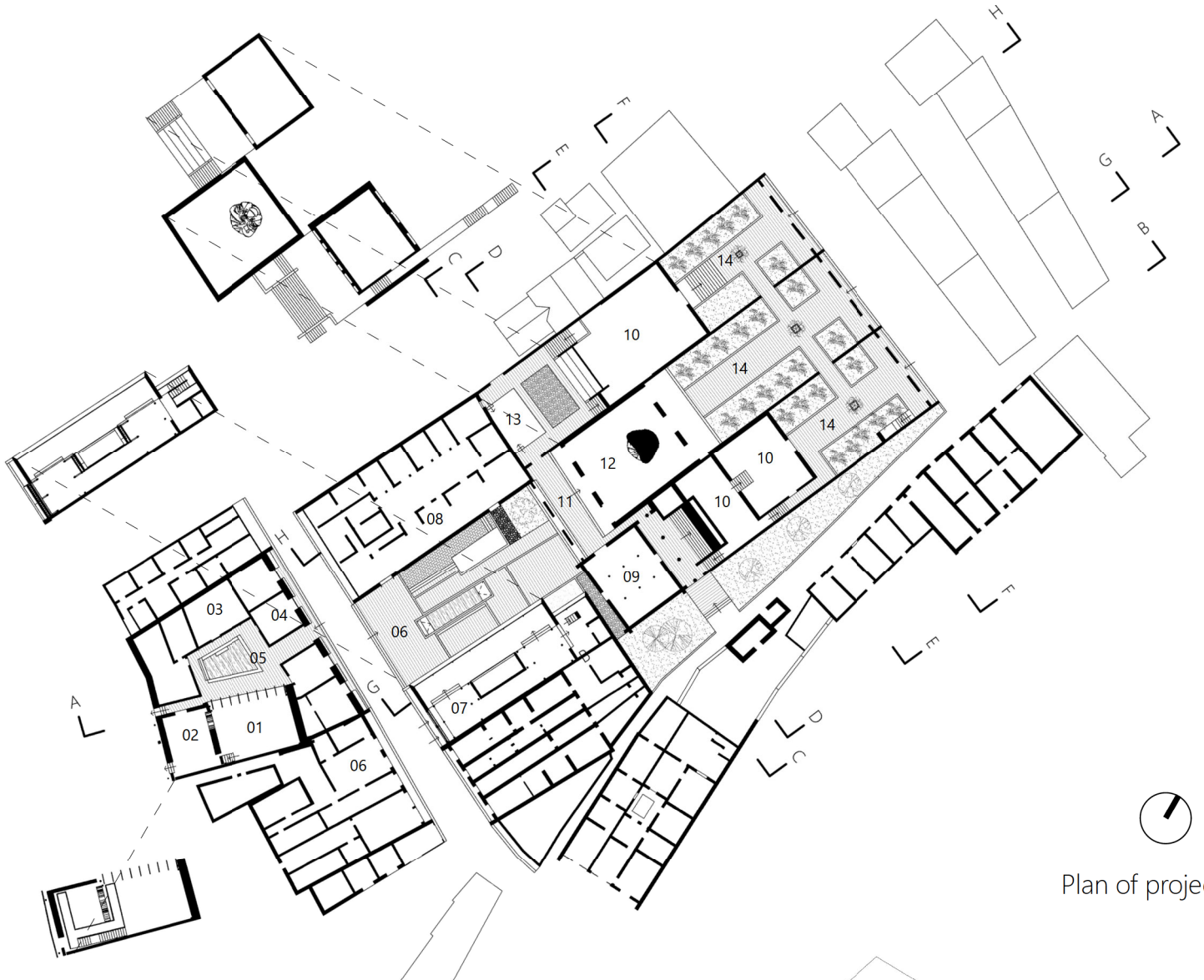


Axonometry of present situation

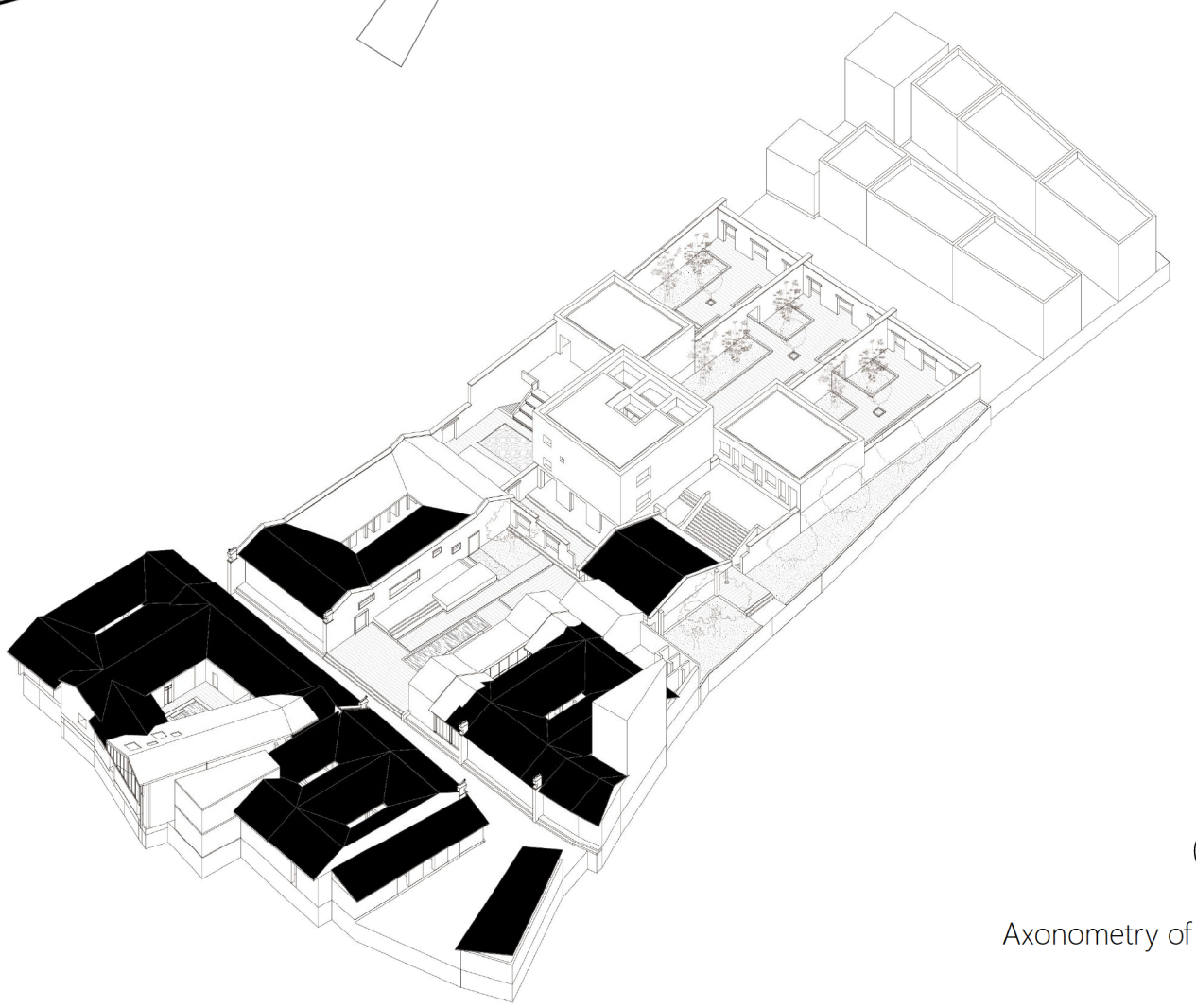


A-A Section of present situation

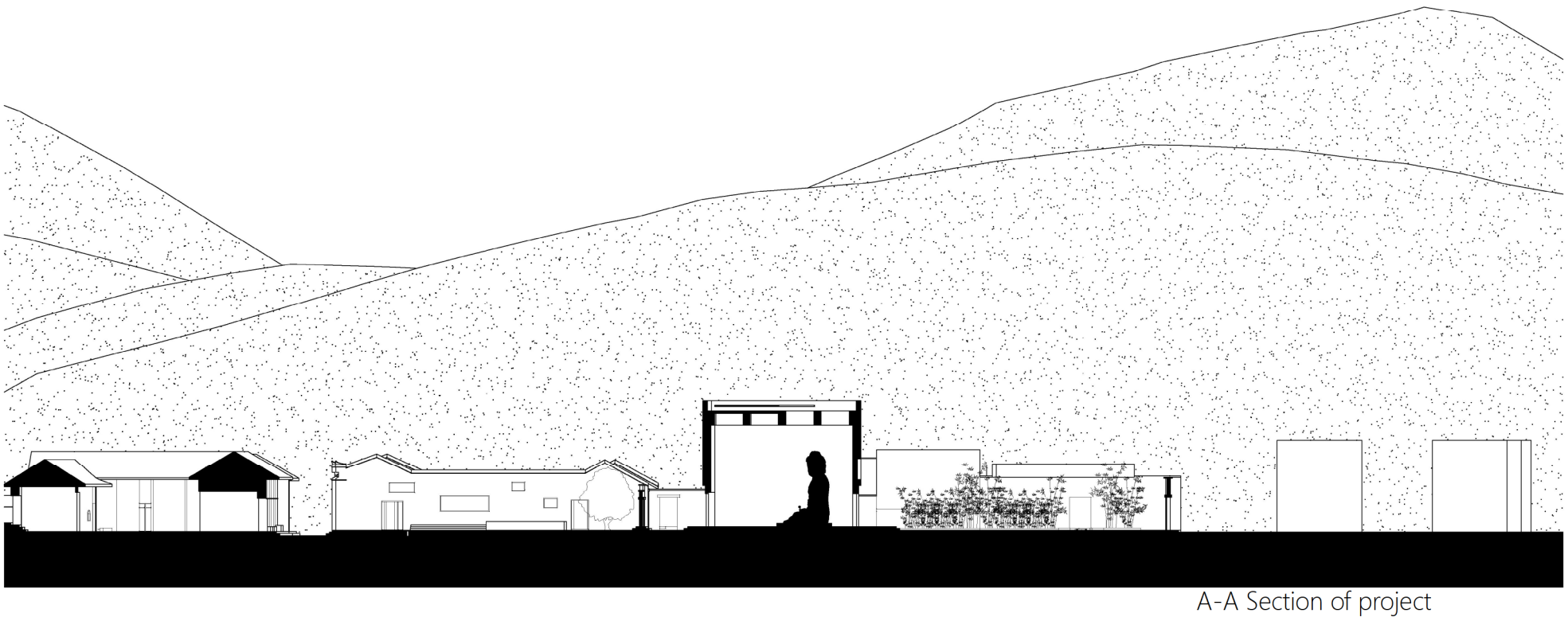
01. Exhibition of Wallruins
02. Erlang Temple Museum
03. Meeting Room
04. Exhibition of Ancient Temple
05. Courtyard of Erlang Temple
06. Leisure Square
07. Cafe & Library
08. Retails Hall
09. Exhibition of Old Crafts
10. Urban Memory Museum
11. Foreyard of Urban Temple
12. Urban Temple
13. Stage for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



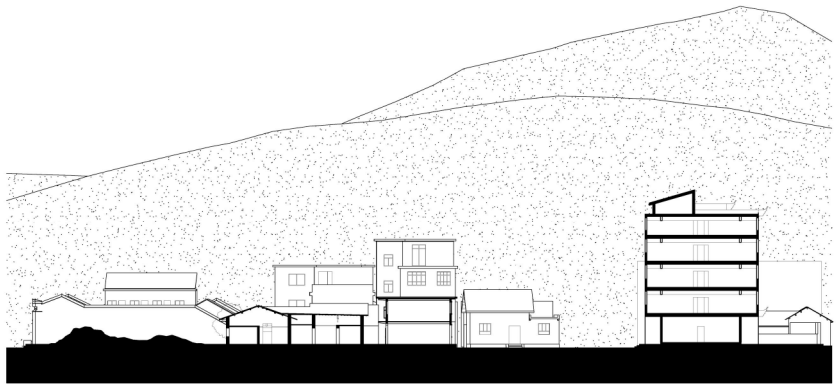
Plan of project



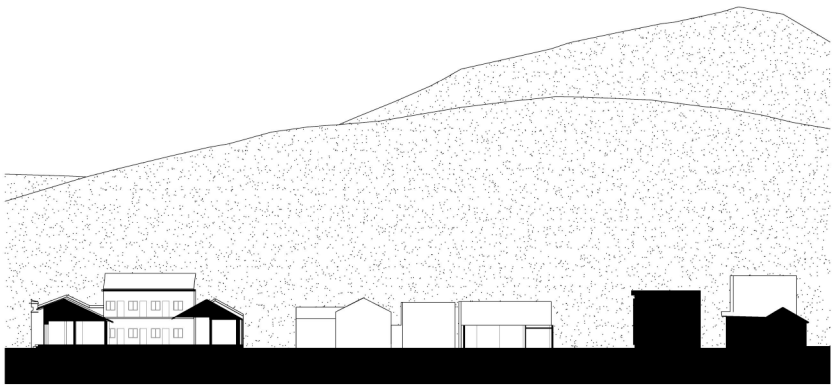
Axonometry of project



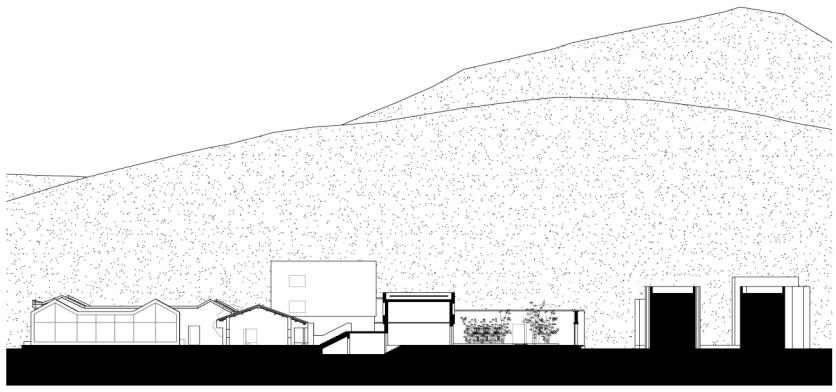
A-A Section of project



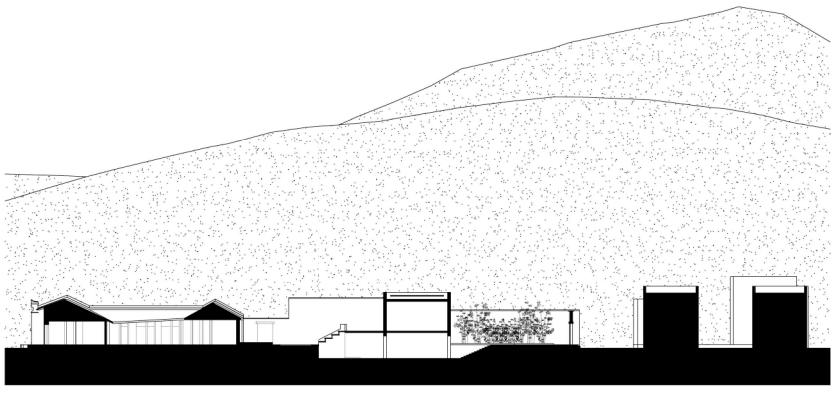
G-G Section of Present Situation



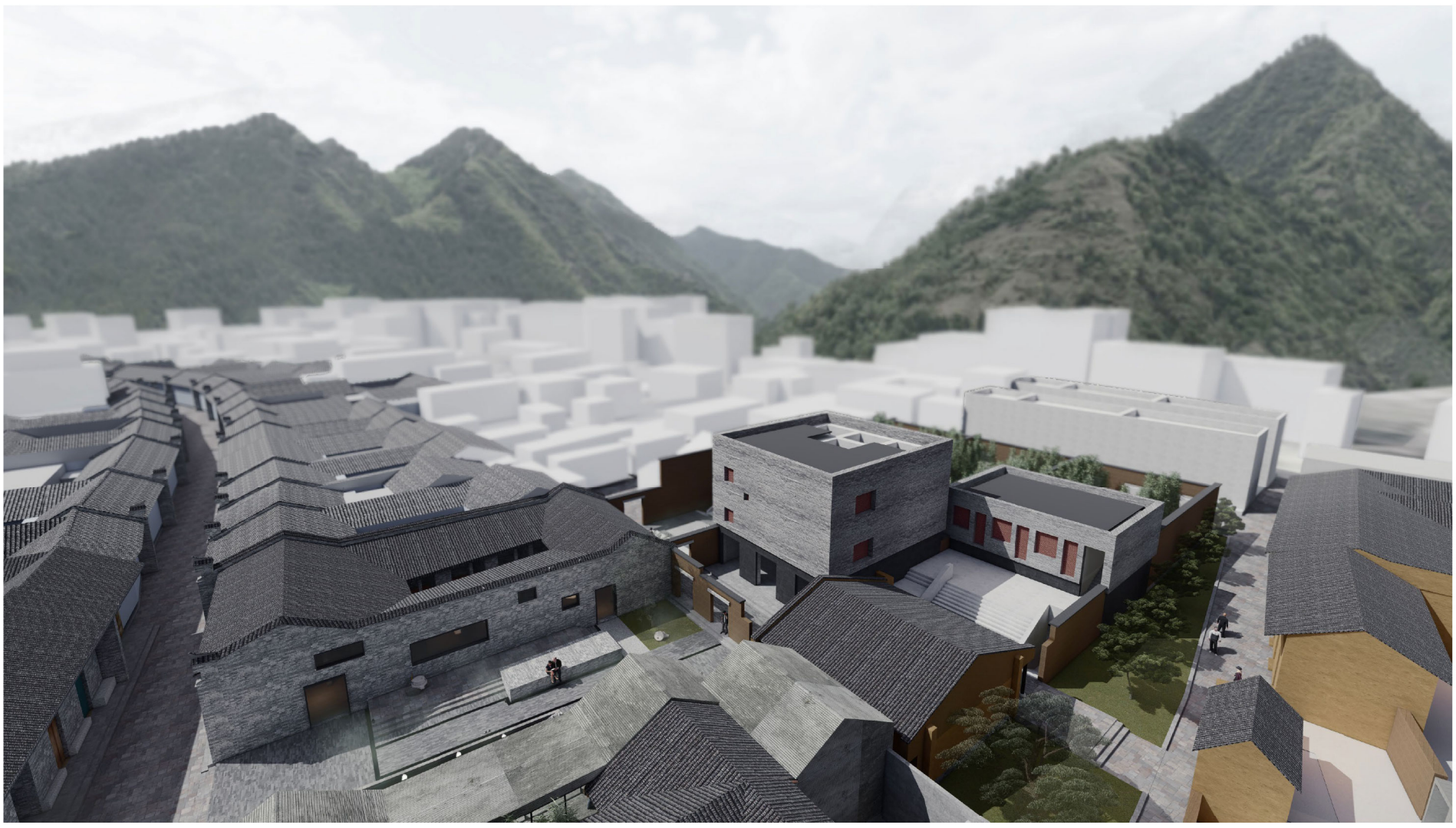
H-H Section of Present Situation



G-G Section of Design

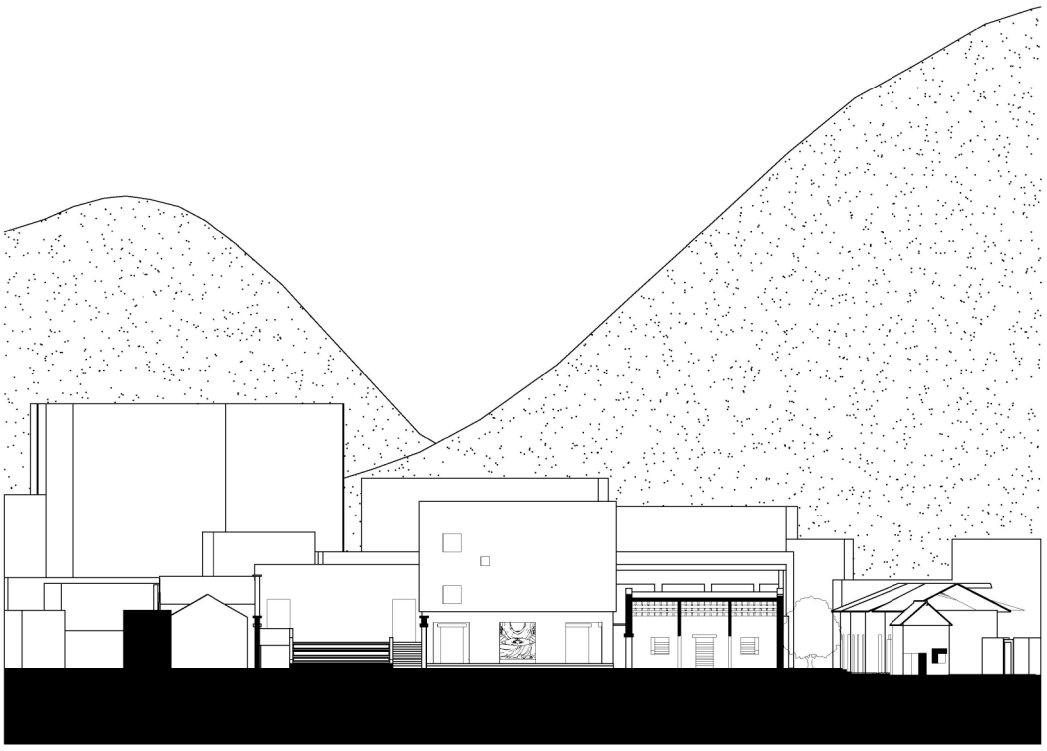


H-H Section of Design



PROJECT AERIAL PERSPECTIVE IN IN-BETWEEN SPACE

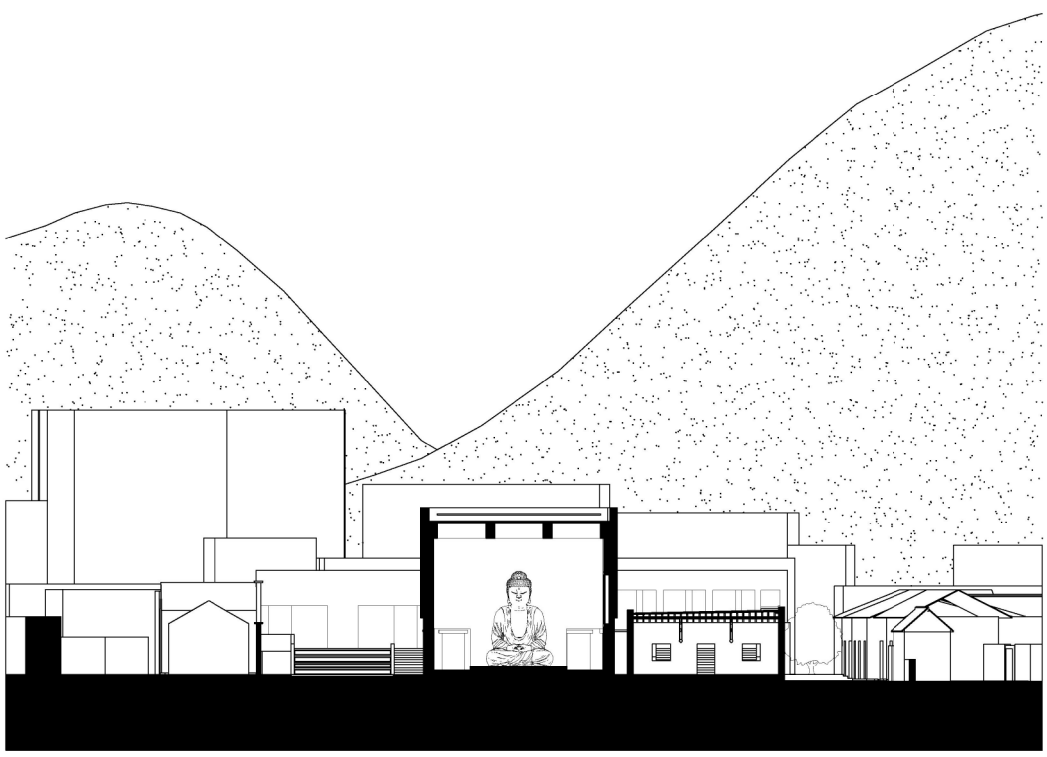
C-C Section of Present Situation



C-C Section of Design

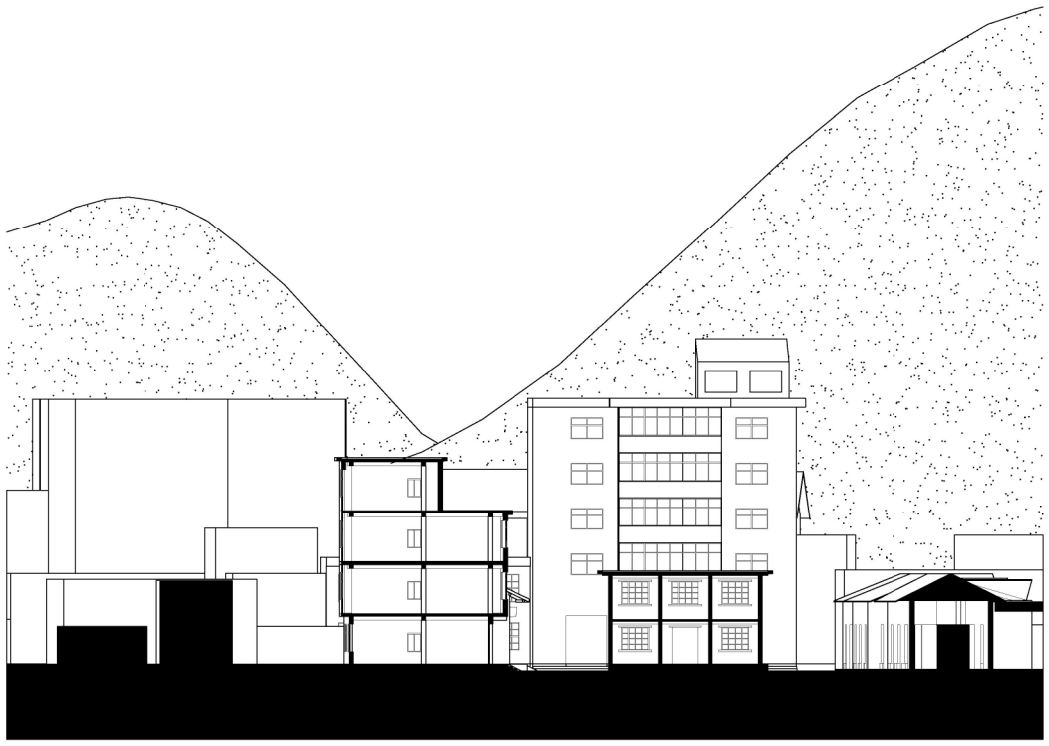
PROJECT PERSPECTIVE FROM THE OLD STREET TO IN-BETWEEN SPACE

D-D Section of Present Situation

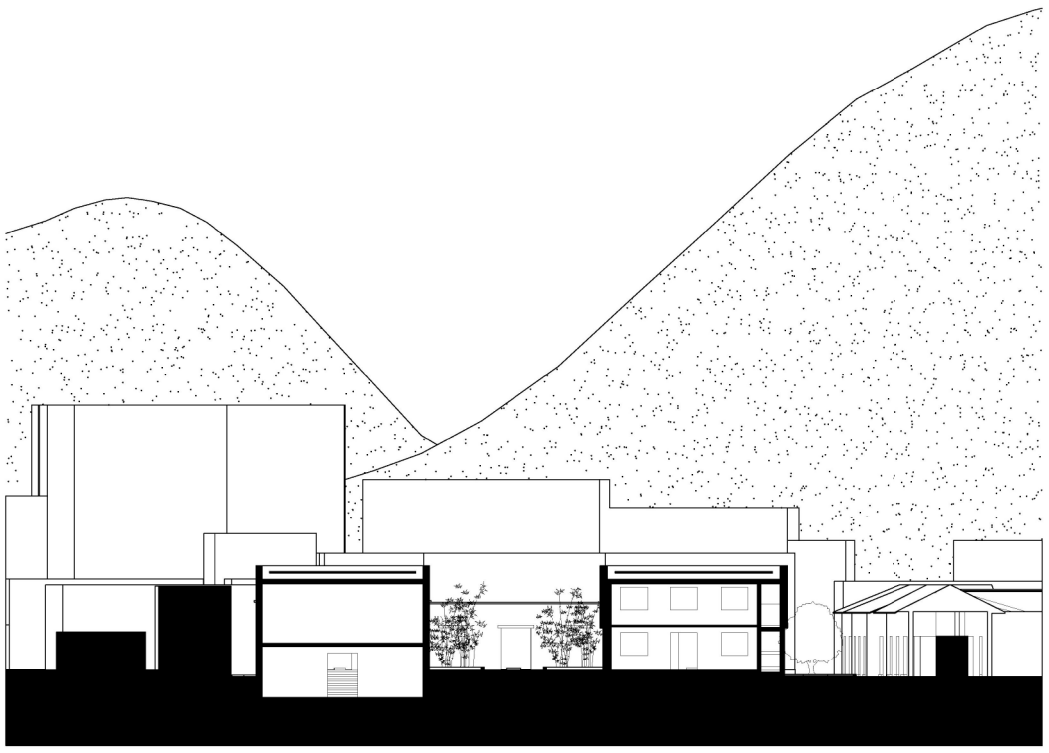


D-D Section of Design

PROJECT PERSPECTIVE OF THE NEW TEMPLE



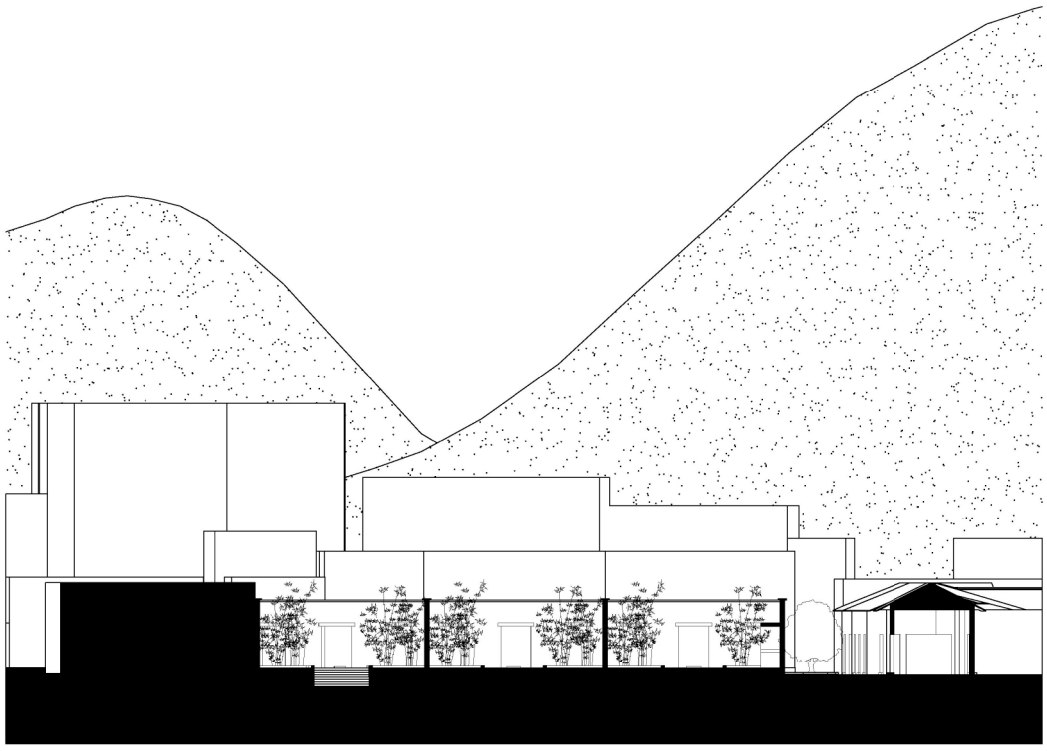
E-E Section of Present Situation



E-E Section of Design

PROJECT PERSPECTIVE FROM THE STAGE

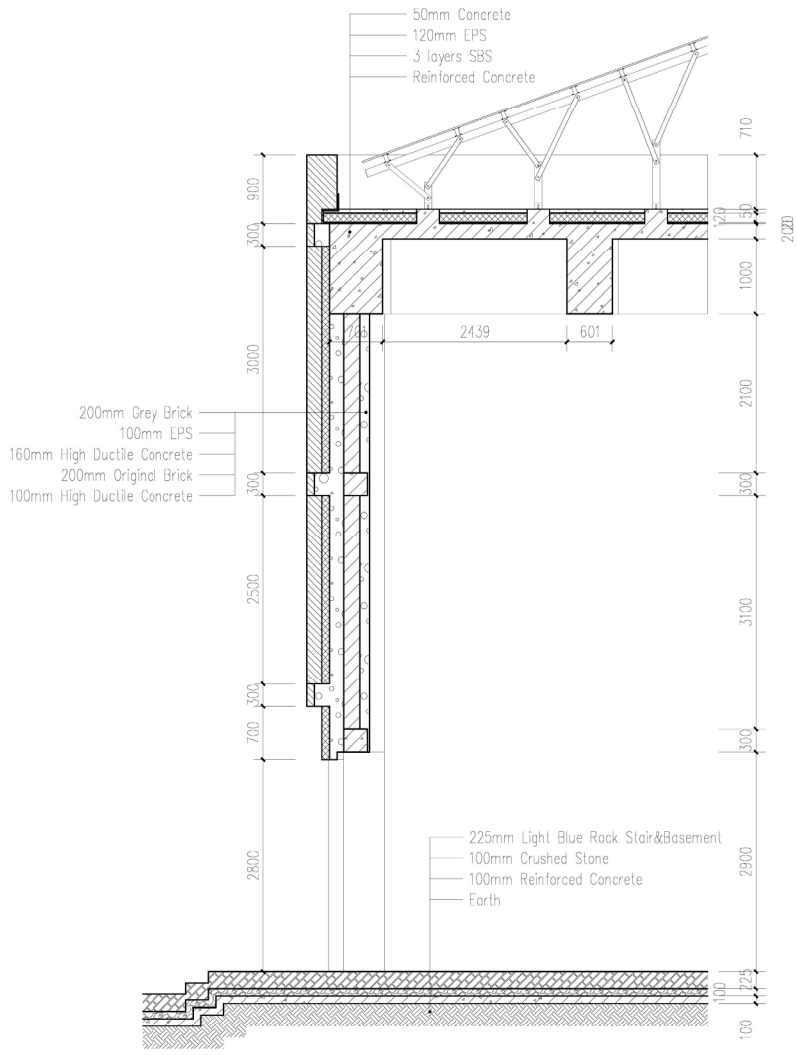
F-F Section of Present Situation



F-F Section of Design

PROJECT PERSPECTIVE OF THE BACKYARD OF THE NEW TEMPLE

B-B Section of Present Situation (with Picture)



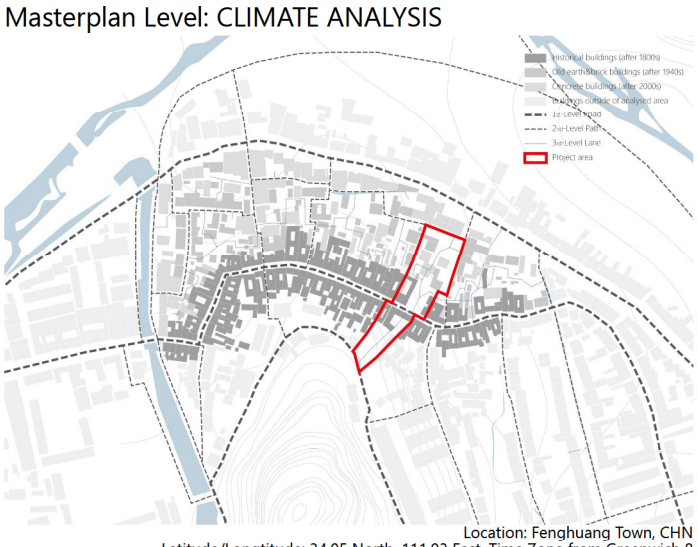
A-A Section of Urban Temple WIth Details 1:50

A-A Section of Present Situation (with Picture)

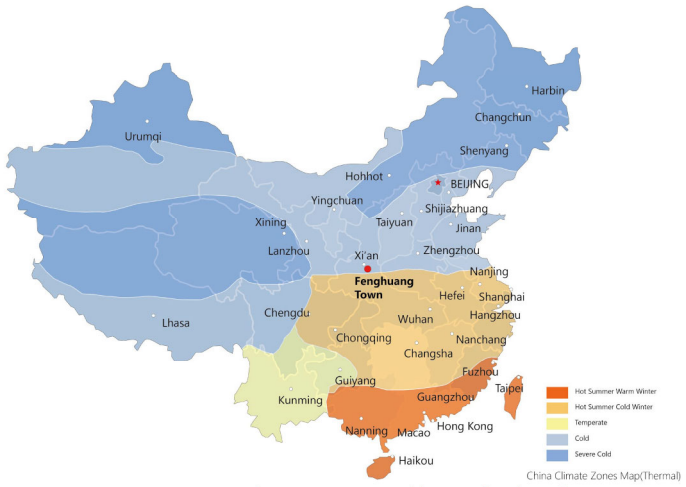
C-C Section of Present Situation (with Picture)

PROJECT PERSPECTIVE UNDER THE STAIRS OF THE STAGE

Masterplan Level: CLIMATE ANALYSIS



Location: Fenghuang Town, CHN
Latitude/Longtitude: 34.05 North, 111.03 East, Time Zone from Greenwich 8
Data Source: CSWD S70670 Station Number, Elevation 568m



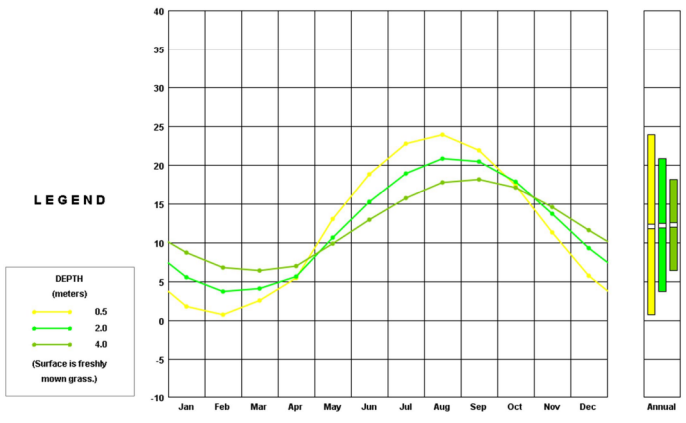
Fenghuang Town is in a cold area in the China Climate Zones Map

Fenghuang Town is in a Humid Continent, Warm Summer area in the China Climate Zones Map

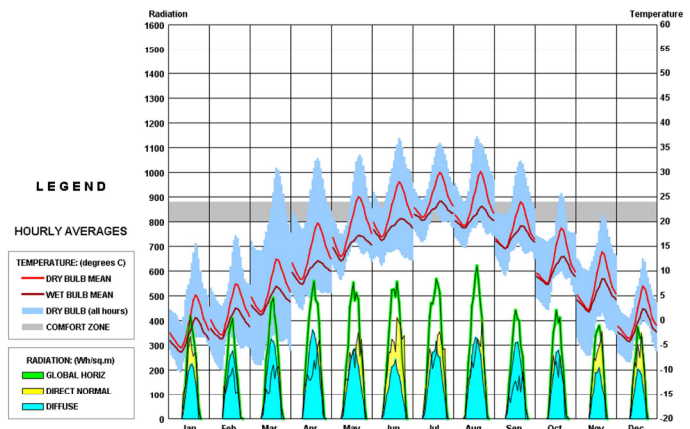
CLIMATE CONSULTANT ANALYSIS

MONTHLY MEANS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Global Horiz Radiation (Avg Hourly)	239	232	278	330	320	321	338	351	255	261	234	221	Wh/sq.m
Direct Normal Radiation (Avg Hourly)	207	132	136	174	213	259	232	222	112	159	206	210	Wh/sq.m
Diffuse Radiation (Avg Hourly)	137	162	192	206	161	131	174	194	182	162	121	121	Wh/sq.m
Global Horiz Radiation (Max Hourly)	831	950	1073	1095	1119	1204	1135	1244	1108	963	827	764	Wh/sq.m
Direct Normal Radiation (Max Hourly)	783	790	790	788	783	769	769	778	781	783	780	770	Wh/sq.m
Diffuse Radiation (Max Hourly)	370	514	457	535	660	562	545	577	545	485	391	353	Wh/sq.m
Global Horiz Radiation (Avg Daily Total)	2398	2487	3299	4258	4421	4577	4743	4643	3125	2885	2400	2164	Wh/sq.m
Direct Normal Radiation (Avg Daily Total)	2072	1410	1627	2257	2948	3700	3254	2937	1386	1752	2106	2050	Wh/sq.m
Diffuse Radiation (Avg Daily Total)	1375	1736	2273	2655	2233	1865	2441	2566	2226	1804	1243	1187	Wh/sq.m
Global Horiz Illumination (Avg Hourly)													lux
Direct Normal Illumination (Avg Hourly)													lux
Dry Bulb Temperature (Avg Monthly)	0	1	6	13	18	22	24	23	18	12	7	0	degrees C
Dew Point Temperature (Avg Monthly)	-7	-4	1	6	12	17	21	19	15	8	2	-4	degrees C
Relative Humidity (Avg Monthly)	62	65	72	69	71	76	81	79	87	81	75	69	percent
Wind Direction (Monthly Mode)	70	70	90	90	90	250	250	230	70	90	70	90	degrees
Wind Speed (Avg Monthly)	0	1	1	1	1	0	0	0	0	0	0	0	m/s
Ground Temperature (Avg Monthly of 3 Depths)	4	3	4	5	10	15	18	20	19	17	12	8	degrees C

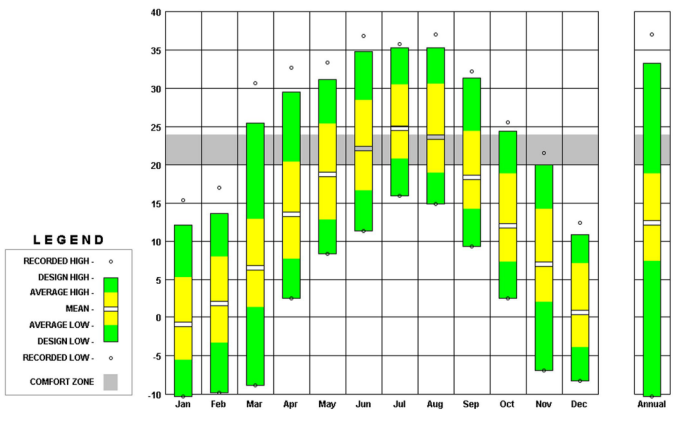
WEATHER DATA SUMMERY
California Energy Code



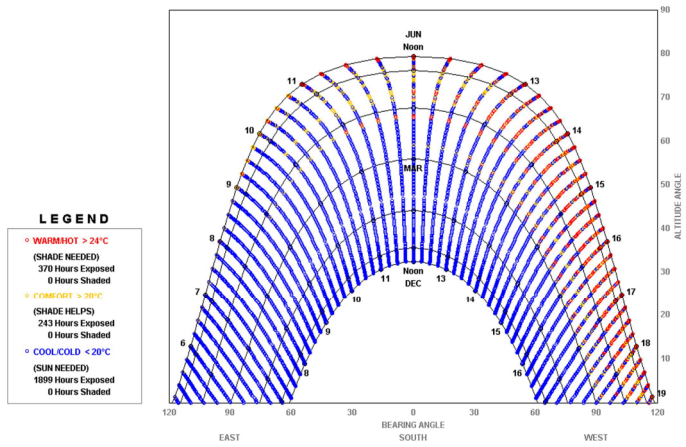
GROUND TEMPERATURE (MONTHLY AVERAGE)
The temperature underground is more stable



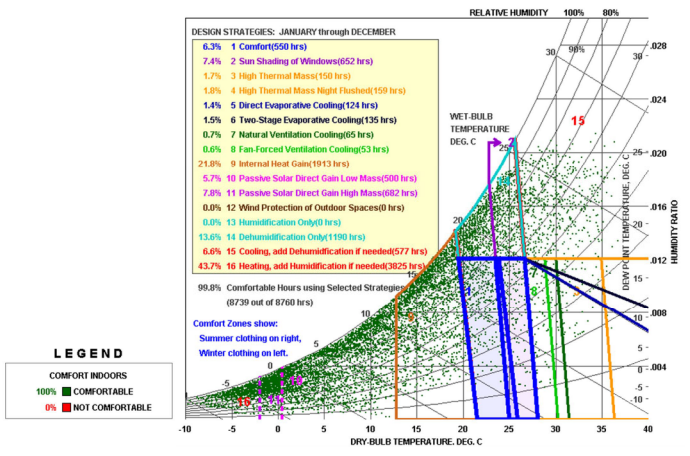
MONTHLY DIURNAL AVERAGES
The solar radition dosen't change dramatically in one year



TEMPERATURE RANGE
The temperature is merely out of comfort zone without control systems

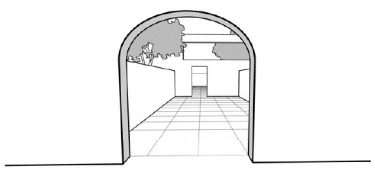


SUN SHADING CHART
The shading system is required for summer afternoon
when buildings are subjected to high sun exposure

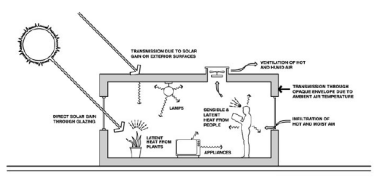


PSYCHOMETRIC CHART
Getting the suggestions from CLIMATE CONSULTANT

CLIMATE CONSULTANT ANALYSIS
GENERATE STRATEGY FROM CLIMATE CONSULTANT

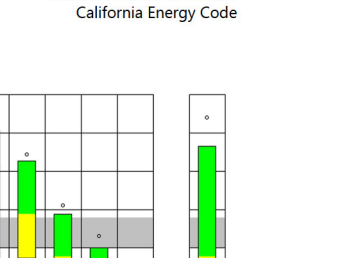


⑧
Sunny wind-protected outdoor spaces can extend living areas in cool weather (seasonal sun rooms, enclosed patios, courtyards, or verandahs)



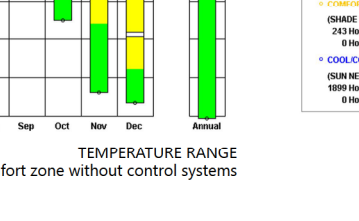
⑪
Heat gain from lights, people, and equipment greatly reduces heating needs so keep home tight, well insulated (to lower Balance Point temperature)

⑫
Insulating blinds, heavy draperies, or operable window shutters will help reduce winter night time heat losses



⑯
Trees (neither conifer or deciduous) should not be planted in front of passive solar windows, but are OK beyond 45 degrees from each corne

⑱
Keep the building small (right-sized) because excessive floor area wastes heating and cooling energy

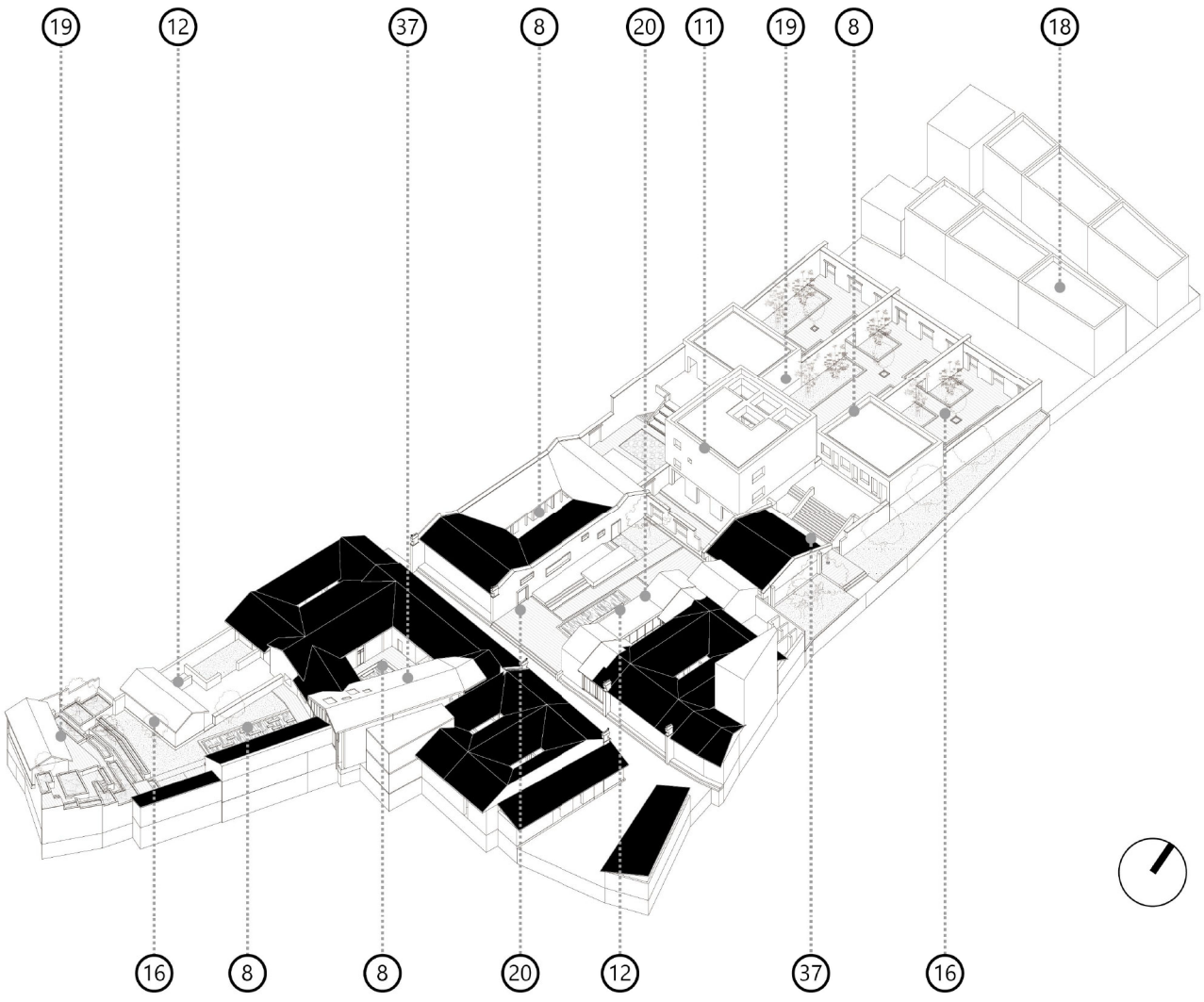


⑲
For passive solar heating face most of the glass area south to maximize winter sun exposure, but design overhangs to fully shade in summer

⑳
Provide double pane high performance glazing (Low-E) on west, north, and east, but clear on south for maximum passive solar gain

37
Window overhangs (designed for this latitude) or operable sunshades (awnings that extend in summer) can reduce or eliminate air conditioning

STRATEGY APPLICATION EXAMPLE IN PROJECT



CLIMATE CONSULTANT ANALYSIS

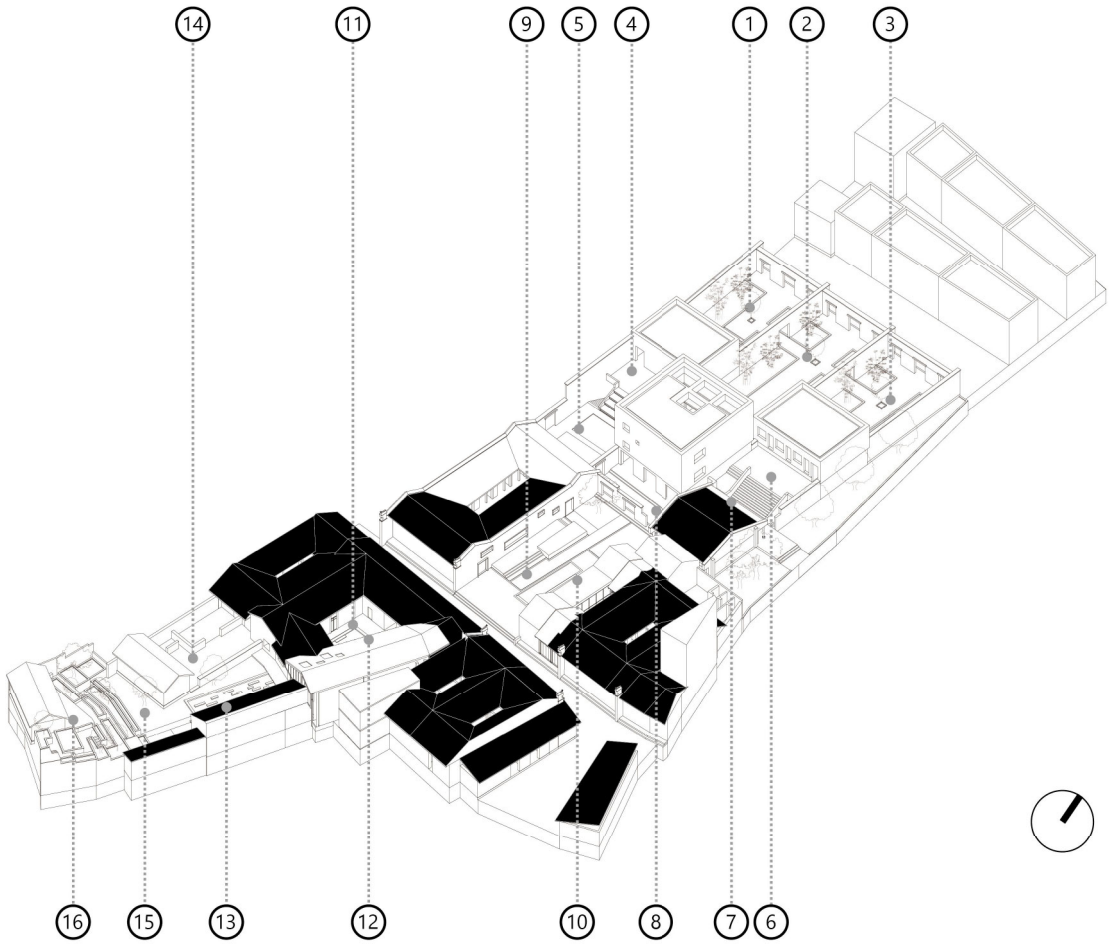
SHADING ANALYSIS

Summer solstice

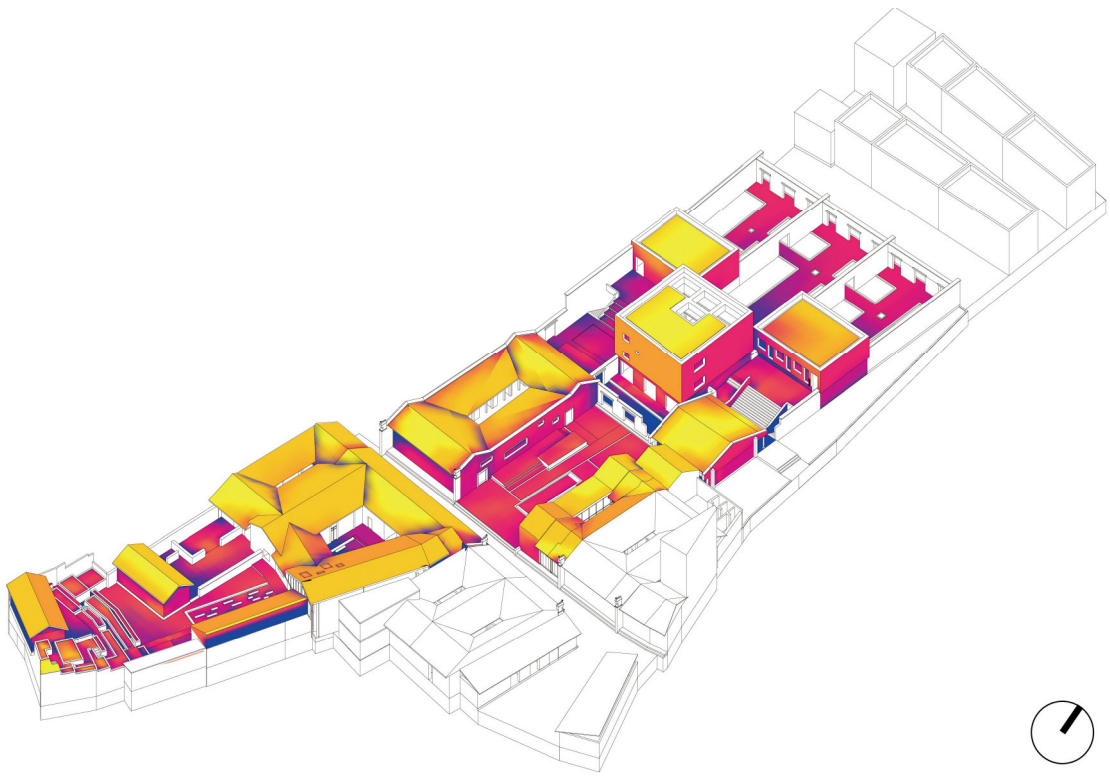
Open space have good shading in the summer solstice, and it would be better with some plants inside.

Winter solstice

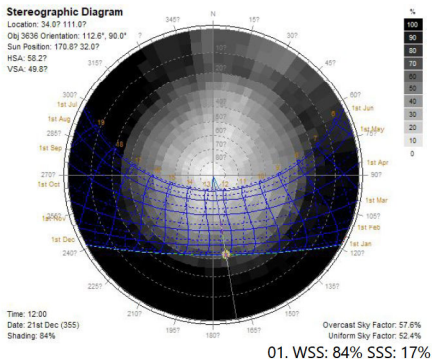
The roof have good sun shine situation, although some courtyard might only get sunshine in particularly time period.



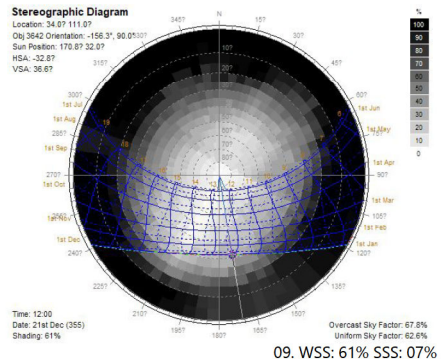
SHADING ANALYSIS IN IMPORTANT PIAZZA & FACADE



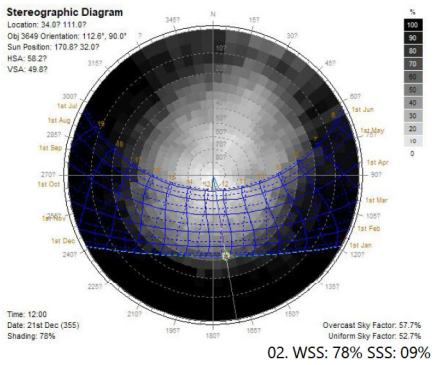
SHADING TIME (AT WINTER SOLSTICE)



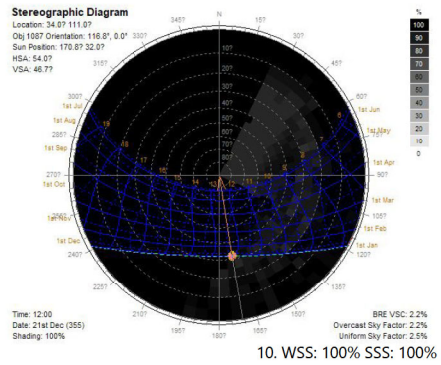
01. WSS: 84% SSS: 17%



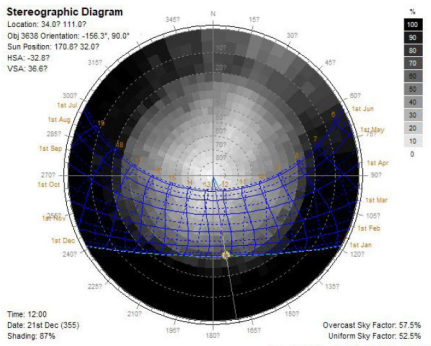
09. WSS: 61% SSS: 07%



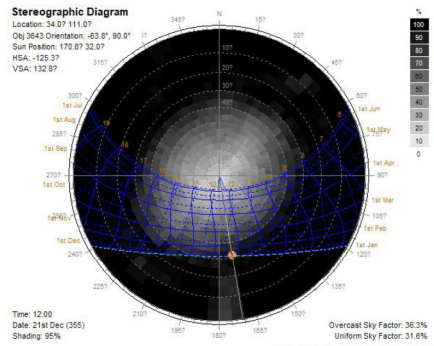
02. WSS: 78% SSS: 09%



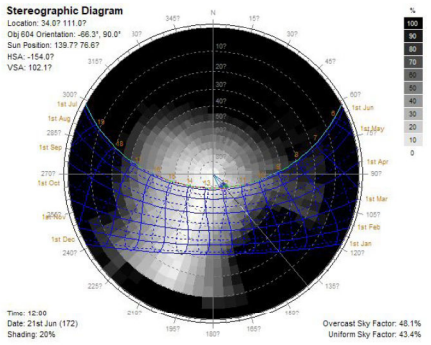
10. WSS: 100% SSS: 100%



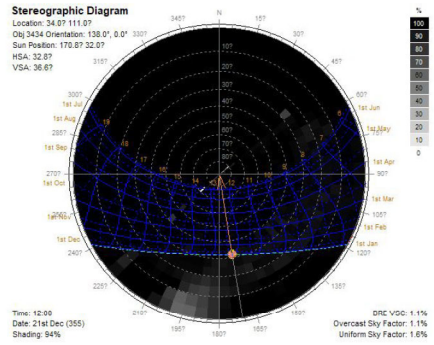
03. WSS: 87% SSS: 20%



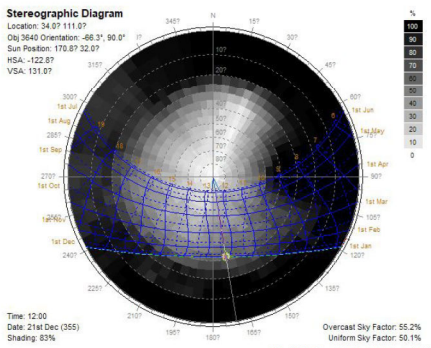
11. WSS: 95% SSS: 29%



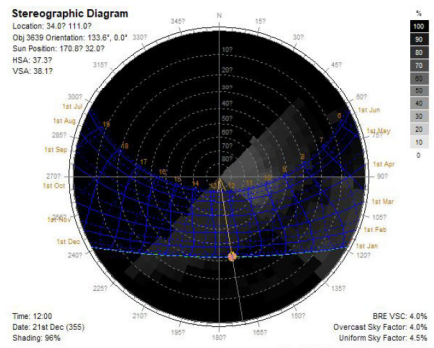
04. WSS: 82% SSS: 20%



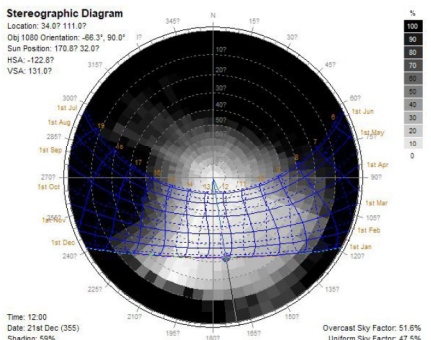
12. WSS: 94% SSS: 100%



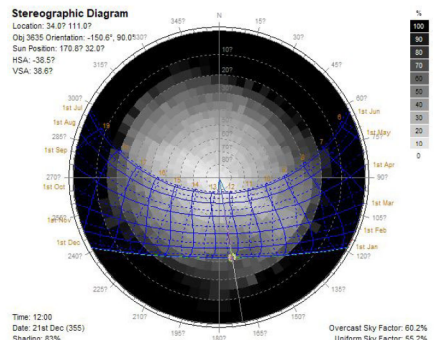
05. WSS: 83% SSS: 26%



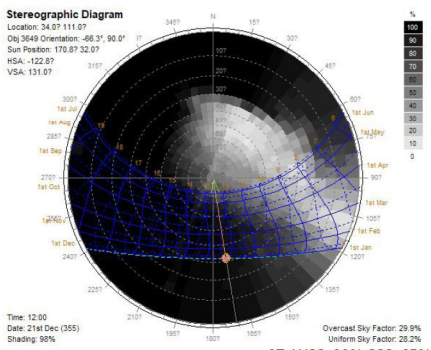
13. WSS: 96% SSS: 97%



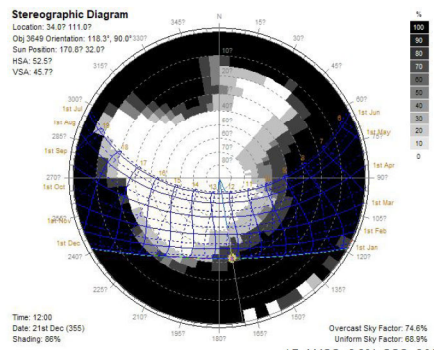
06. WSS: 59% SSS: 07%



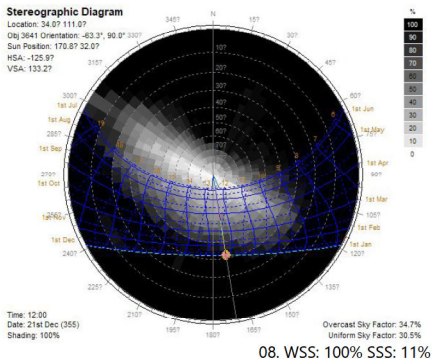
14. WSS: 83% SSS: 12%



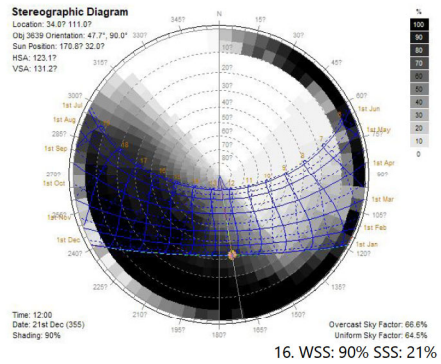
07. WSS: 98% SSS: 65%



15. WSS: 86% SSS: 2%



08. WSS: 100% SSS: 11%



16. WSS: 90% SSS: 21%

Site Conditions		Estimate	Notes/Range
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	Notes/Range
Base Case HVAC System			
Building has air-conditioning?	yes/no	Yes	
Heating fuel type	-	Electricity	
Heating system seasonal efficiency	%	100%	55% to 350%
Air-conditioner seasonal COP	-	3.1	2.4 to 5.0
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	Notes/Range
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	2.0 to 5.0
Cooling			
Electricity used	MWh	4.8	
GSHP cooling energy delivered	MWh	21.9	
	million Btu	74.8	
Seasonal cooling COP		4.5	2.0 to 5.5
Seasonal cooling EER	(Btu/h)/W	15.5	7.0 to 19.0

RETScreen® Greenhouse Gas (GHG) Emission Reduction Analysis - Ground-Source Heat Pump Project

Use GHG analysis sheet? Yes Type of analysis: Standard

Background Information

Project Information
Project name: Fenghuang
Project location: Fenghuang, China

Global Warming Potential of GHG
1 tonne CH_4 = 21 tonnes CO_2 (IPCC 1996)
1 tonne N_2O = 310 tonnes CO_2 (IPCC 1996)

Base Case Electricity System (Baseline)

Fuel type	Fuel mix (%)	CO_2 emission factor (kg/GJ)	CH_4 emission factor (kg/GJ)	N_2O emission factor (kg/GJ)	Fuel conversion efficiency (%)	T & D losses (%)	GHG emission factor (t_{CO2}/MWh)
Coal	12.8%	94.6	0.0020	0.0030	35.0%	8.0%	1.069
Natural gas	2.0%	56.1	0.0030	0.0010	45.0%		0.452
#6 oil	0.2%	77.4	0.0030	0.0020	30.0%		0.937
Large hydro	18.6%	0.0	0.0000	0.0000	100.0%		0.000
Nuclear	2.3%	0.0	0.0000	0.0000	30.0%		0.000
Solar	4.3%	0.0	0.0000	0.0000	100.0%		0.000
Electricity mix	100%	216.3	0.0047	0.0068		5.8%	0.787

Base Case Heating and Cooling System (Baseline)

Fuel type	Fuel mix (%)	CO_2 emission factor (kg/GJ)	CH_4 emission factor (kg/GJ)	N_2O emission factor (kg/GJ)	Fuel conversion efficiency (%)	GHG emission factor (t_{CO2}/MWh)
Heating system						
Electricity	100.0%	216.3	0.0047	0.0068	100.0%	0.787
Cooling system						
Electricity	100.0%	216.3	0.0047	0.0068	314.5%	0.250

Proposed Case Heating and Cooling System (Ground-Source Heat Pump Project)

Fuel type	Fuel mix (%)	CO_2 emission factor (kg/GJ)	CH_4 emission factor (kg/GJ)	N_2O emission factor (kg/GJ)	Fuel conversion efficiency (%)	GHG emission factor (t_{CO2}/MWh)
Heating system						
Electricity	100.0%	216.3	0.0047	0.0068	256.0%	0.307
Cooling system						
Electricity	100.0%	216.3	0.0047	0.0068	364.2%	0.216

GHG Emission Reduction Summary

	Base case GHG emission factor (t_{CO2}/MWh)	Proposed case GHG emission factor (t_{CO2}/MWh)	End-use annual energy delivered (MWh)	Annual GHG emission reduction (t_{CO2})
Heating system	0.787	0.307	26.6	12.74
Cooling system	0.250	0.216	14.8	0.50
			Net GHG emission reduction t_{CO2}/yr	13.24

RETScreen® Heating and Cooling Load Calculation - Ground-Source Heat Pump Project

Site Conditions		Estimate	Notes/Range
Nearest location for weather data		Fenghuang	
Heating design temperature	°C	-10.4	-40.0 to 15.0
Cooling design temperature	°C	30.8	10.0 to 40.0
Average summer daily temperature range	°C	10.3	5.0 to 15.0
Cooling humidity level	-	Medium	
Latitude of project location	°N	34.1	-90.0 to 90.0
Mean earth temperature	°C	13.5	
Annual earth temperature amplitude	°C	22.4	5.0 to 20.0
Depth of measurement of earth temperature	m	0.0	0.0 to 3.0

Building Heating and Cooling Load		Estimate	Notes/Range
Type of building	-	Commercial	
Available information	-	Energy use data	
Design heating load	kW	7.6	
	million Btu/h	0.026	
Annual heating energy demand	MWh	61.2	
	million Btu	208.8	
Design cooling load	kW	6.1	
	ton (cooling)	1.7	
Annual cooling energy demand	MWh	37.8	
	million Btu	129.0	

RETScreen® Energy Model - Photovoltaic Project

Site Conditions		Estimate	Notes/Range
Project name		Rewriting	
Project location		Fenghuang, China	
Nearest location for weather data	-	Fenghuang	
Latitude of project location	°N	34.1	-90.0 to 90.0
Annual solar radiation (tilted surface)	MWh/m²	1.61	
Annual average temperature	°C	12.8	-20.0 to 30.0

System Characteristics		Estimate	Notes/Range
Application type	-	On-grid	
Grid type	-	Central-grid	
PV energy absorption rate	%	100.0%	
PV Array			
PV module type	-	mono-Si	
PV module manufacturer / model #		SES 450J	
Nominal PV module efficiency	%	11.1%	4.0% to 15.0%
NOCT	°C	45	40 to 55
PV temperature coefficient	% / °C	0.40%	0.10% to 0.50%
Miscellaneous PV array losses	%	5.0%	0.0% to 20.0%
Nominal PV array power	kWp	23.40	
PV array area	m²	210.8	
Power Conditioning			
Average inverter efficiency	%	90%	80% to 95%
Suggested inverter (DC to AC) capacity	kW (AC)	21.1	
Inverter capacity	kW (AC)	72.0	
Miscellaneous power conditioning losses	%	0%	0% to 10%

Annual Energy Production (12.00 months analysed)		Estimate	Notes/Range
Specific yield	kWh/m²	148.4	
Overall PV system efficiency	%	9.2%	
PV system capacity factor	%	15.3%	
Renewable energy collected	MWh	34.754	
Renewable energy delivered	MWh	**31.279**	
	kWh	31.279	
Excess RE available	MWh	**0.000**	

RETScreen® Solar Resource and System Load Calculation - Photovoltaic Project

Site Latitude and PV Array Orientation		Estimate	Notes/Range
Nearest location for weather data		Fenghuang	
Latitude of project location	°N	34.1	-90.0 to 90.0
PV array tracking mode	-	Fixed	
Slope of PV array	°	30.0	0.0 to 90.0
Azimuth of PV array	°	0.0	0.0 to 180.0

Monthly Inputs

Month	Fraction of month used (0 - 1)	Monthly average daily radiation on horizontal surface (kWh/m²/d)	Monthly average temperature (°C)	Monthly average daily radiation in plane of PV array (kWh/m²/d)	Monthly solar fraction (%)
January	1.00	2.88	-0.5	4.25	-
February	1.00	3.40	2.3	4.36	-
March	1.00	4.10	7.3	4.61	-
April	1.00	5.00	14.3	5.08	-
May	1.00	5.31	18.6	5.01	-
June	1.00	5.27	22.7	4.83	-
July	1.00	5.00	25.0	4.65	-
August	1.00	4.48	23.7	4.40	-
September	1.00	3.72	18.9	3.94	-
October	1.00	3.24	13.1	3.87	-
November	1.00	2.81	6.7	3.91	-
December	1.00	2.59	0.9	3.94	-

		Annual	Season of use
Solar radiation (horizontal)	MWh/m²	1.45	1.45
Solar radiation (tilted surface)	MWh/m²	1.61	1.61
Average temperature	°C	12.8	12.8

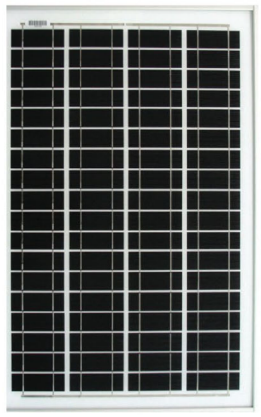
Load Characteristics		Estimate
Application type	-	On-grid

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	36000	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	-15~45			
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'/40'HQ	21/48/96	21/48/96	21/48/96	21/48/96

Basic Info
Model No.: BGB35-135/P



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

50W Photovoltaic module – **450J**

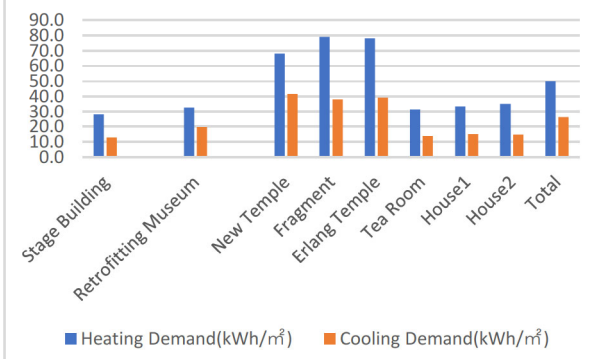
Electrical characteristics	(1) STC 1000W/m²	(2) NOCT 800W/m²
Maximum power (P_{max})	50W	36W
Voltage at Pmax (V_{mpp})	17.5V	15.6V
Current at Pmax (I_{mpp})	2.90A	2.32A
Short circuit current (I_{sc})	3.20A	2.59A
Open circuit voltage (V_{oc})	21.8V	19.8V
Module efficiency	11.1%	
Tolerance Pmax	± 10%	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

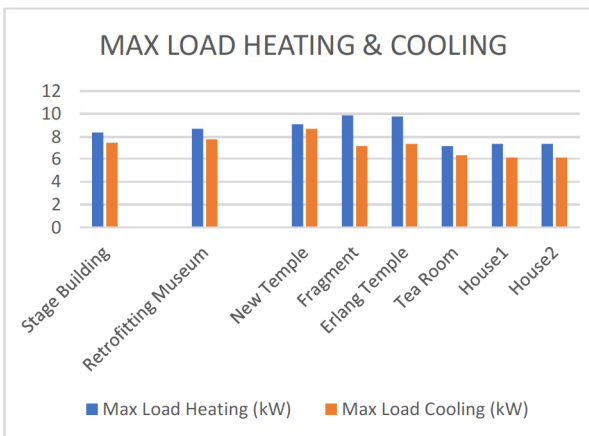
1: Values at Standard Test Conditions (STC): 1000W/m² irradiance, AM1.5 solar spectrum and 25°C module temperature
2: Values at 800W/m² irradiance, Nominal Operation Cell Temperature (NOCT) and AM1.5 solar spectrum
3: Nominal Operation Cell Temperature: Module operation temperature at 800W/m² irradiance,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

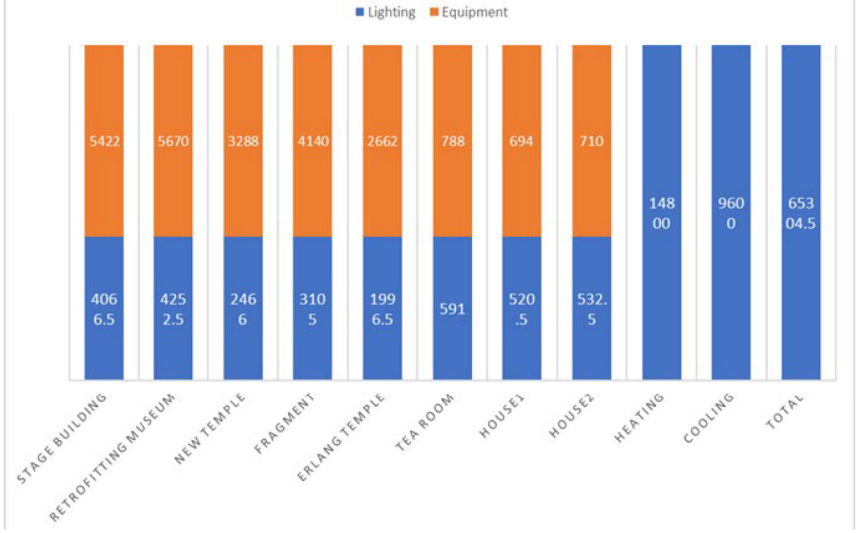
All solar modules are individually tested prior to shipment; an allowance is made within our factory measurement to account for the typical power degradation (LID effect) which occurs during the first few days of deployment.

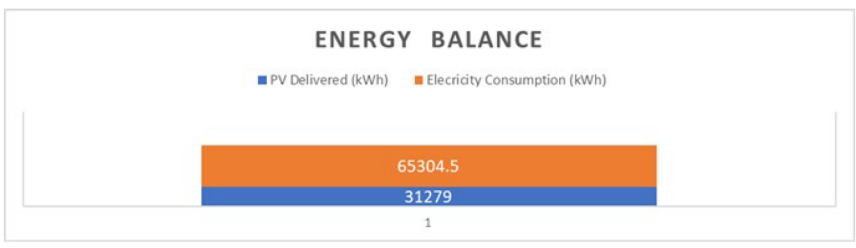
Energy model data caculation

Building	Thermal zone	Area(SQMT)		Average Height	Heating Demand(kWh)		Cooling Demand(kWh)		Heating Demand (kWh/m²)	Cooling Demand (kWh/m²)	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	/	/









Position of project and energy equipment