

CHAPTER I

BACKGROUND

1.1. Background

Chinese architecture – an architectural style developed in China over a period of millenia before spreading out its influence throughout East Asia. The style itself began its solidification in the early days of imperial era (Qin Dynasty, circa 221 BC). Significant changes made were only to the decorative elements of the style; while the structural principles remain mostly unchanged. By Tang Dynasty (circa AD 618), the architectural style has had a major influence on Japan, Korea, and Mongolia; also a varying amount of South and Southeast Asian countries including Sri Lanka, Vietnam, Thailand, Phillipines, and Indonesia (Steinhardt, 2004). One of the most popular features of traditional Chinese architecture style is the incorporation of *Feng shui* – a pseudoscience originating from ancient China which claims to use energy forces to harmonize individuals with their surrounding environment (Matthews, 2017). *Feng shui* is one of the Five Arts of Chinese Metaphysics; classified as physiognomy (observation of appearances through formulas and calculations). The practice discusses architecture in terms of 'invisible forces' that bind the universe, earth, and humanity together – namely *qi*. On present day, *Feng shui* was regarded as a uniquely ancient Asian architectural tradition (Park, Furukawa, & Yamada, 1996), and are still being used by planners including architects, landscape ecologists, landscape architects, environmental scientists, and geographers.

On a topic of influence, East Asian countries were among the very first ones to receive an input of a grand scale after Tang Dynasty; an era when much of Chinese culture was imported en masse by the neighboring nations. In South East Asia, the architecture has underlying influences found in various countries. Certain Chinese architectural techniques were adopted by Thai artisans, some temple and palace rooftops were also built in Chinese style, and Chinese style buildings can be found in Ayutthaya – a nod towards the large numbers of Chinese shipbuilders, sailors, and traders who came to the country (Sthapitanonda & Mertens, 2012). In Indonesia, mosques bearing Chinese influence can be found in certain parts of the country. This influence is recent in comparison to other parts of Asia and is largely due to the sizable Chinese Indonesian community (Formichi, 2013). Chinese architectural sensibilities have also influenced Vietnam; where it would also adopt the East Asian hip and gable roof style (Steinhardt, 2004).

The first ever recorded movement of China into Maritime Southeast Asia was the arrival of Mongol forces under Kublai Khan; culminated in the invasion of Java in 1293. This intervention would later lead to Singhasari's decline and the rise of Majapahit Empire (Reid, 2001). On the next movement, Chinese muslim traders from eastern coast of China arrived at coastal towns of Indonesia and Malaysia in the early 15th century. Led by mariner Zheng He – who commanded several expeditions to southeastern Asia between 1405-1433 – these traders settled along the northern coast of Java and the legacy left was documented into the book *Yingya Shenglan* (Ma R. W., 2005). No particular settlements were recorded/documentated beyond 16th century, yet it is likely for the muslim Chinese to have been absorbed into the majority of muslim population (Tan, 2005). Three cities were left with many of Zheng He and his men's legacy: Semarang (formerly *Sampotoalang*), Surabaya (formerly *Ujung Galuh*), and Lasem (formerly *Lao Sam*). On present day, many of these legacy and ones that were built 300-400 years later still strictly follow the core principals of traditional Chinese architecture. The urban complexes that still exist in these cities were established as 'Chinatown' and preserved as cultural heritage districts.

Majority of traditional Chinese architecture in Indonesia have stood the test of time; and the everchanging climate conditions. Although global temperature average kept fluctuating, the value keeps getting higher by the year and has since doubled ranging from 18th century until present day (NASA, 2019). Initially, most of 15th-16th century Chinese style buildings in Indonesia were built by the Chinese themselves that were brought from the mainland. It does not take long for Indonesian people to start adopting their methods and join the ranks of capable builders who know their way around Chinese style architecture, also incorporating some of Indonesia's indigenous architecture values in the buildings. By the end of 20th century after the dual nationality dilemma faced by Chinese Indonesians, some of the major Chinatown in the country was burned, razed, and looted; following the anti-Chinese sentiments – a stereotype that emerged due to President Soeharto being too reliant on Chinese Indonesian businessmen to further his New Order agenda. Chinatowns that were left after the peak incidents in 1998 were then restored and revived as heritage districts, with most of the original houses restored to their initial forms.

Today there are still an abundance of traditional Chinese buildings in Indonesia adapted to be used in topical conditions. Through many factors, some have been installed with HVAC systems, renovated, and repurposed; while some are still using the same natural

ventilation systems ever since they are built, regardless of its function. Studies regarding heritage buildings in Indonesia are typically about indigenous and/or colonial architecture, and rarely discuss traditional Chinese architecture. Since traditional Chinese architecture in Indonesia is still everpresent, this research is hoped to be able to determine if there are issues in traditional Chinese architecture in terms of thermal performance to light – particularly when faced against Indonesia’s tropical climate conditions.

Claims from citizens that live in these houses vary, yet in unison for the answer: traditional Chinese architecture style in Indonesia is still comfortable enough for the users to live in without the need of an AC system despite the temperature rise due to climate change. This study aims to understand how Chinese style buildings in Indonesia could withstand the climate change in tropical conditions, and to verify the claims of the people living in the houses through means of self-induced surveys and software simulations. The end result will be to find out what parameters have to be modified in order for the buildings to be reach comfortable standards in Indonesia’s tropical climate. Results may change when this research is done to Chinese style buildings outside of Indonesia; mainly on a different climate condition and terrain.

1.2. Research Questions

1. How do traditional chinese architecture style buildings fare on building performance and comfortability in different climate conditions?
2. To what extent does the sample have to be modified in order to reach Indonesian building performance standards and comfort standards?

1.3. Research Aims and Objectives

a. Aims

To identify the building performance of traditional Chinese architecture in different climate conditions; ultimately to discover the how traditional Chinese architecture fares – in adapting to climate change and tropical climate conditions in Indonesia.

b. Objectives

- To gain an understanding of how traditional chinese architecture fare in different climate conditions; which in this case is adapting to climate change and tropical climate conditions in Indonesia.

- To compare which elements of the sample need to be modified – and to what extent – in order to reach Indonesian building performance standards and comfort standards.
- To be used as a guideline/consideration material for future designs that use traditional Chinese architecture as a base style.

1.4. Writing System

CHAPTER I BACKGROUND

Contains background information, research questions, goals and targets, and research authenticity regarding *thermal comfort of traditional Chinese architecture as a whole in different climate conditions and its relation to climate change.*

CHAPTER II LITERATURE REVIEWS

Contains literatures, theories, and regulations; on relevant topics, which will be used to create hypothesis and extrapolate it in the research.

CHAPTER III RESEARCH METHODOLOGIES

Contains detailed means and materials, tools, steps, and analysis required for the research to be initialized. Also presents any kind of limitations and difficulties present during the research – and the corresponding solutions; if applicable.

CHAPTER IV RESULTS AND ANALYSIS

Contains research's final result and a detailed essay on what the result is and how the research came to such result.

CHAPTER V CONCLUSIONS, IMPLICATIONS, AND SUGGESTIONS

Contains accurate statements regarding the results of the research derived from analysis, answers for the research questions, and its implications derived from this research. Also contains suggestion(s) for researchers regarding similar topics or those who may want to continue further on the same topic this thesis was based on.

1.5. Research Authenticity

In order to ensure that this thesis is indeed a state-of-the-art research, an authenticity study was conducted amongst any researches with similar/related topics with this thesis. Sources were gathered from nationally and internationally published journals. The study has been compiled into the following list:

Table 1.1 Research Authenticity Study Comparison List

Title	Author	Year	Content
<i>Creating Thermal Comfort in Buildings (translated)</i>	Basaria Talarosha	2005	This paper aims to solve the thermal comfort in building by architectural solution, designing building by considering orientation to wind direction and sun, using of architectural elements and building materials, also elements of landscape.
<i>The Chinese Evaluation Standard for the Indoor Thermal Environment in Free-running Building</i>	Baizhan Li, Runming Yao, Qinqing Wang, Yangpang Pan, Wei Yu	2012	This paper overviews the investigation of thermal comfort conditions in China and relevant energy efficient issues; while this paper also introduces the requirements for the thermal environment for heated, cooled, and free-running buildings for different climate zones in China – in detail.
<i>Chinese Climate and Vernacular Dwellings</i>	Feifei Sun	2013	This paper explores five different climatic regions into which China is partitioned by the authorities: severe cold region, cold region, moderate region, hot summer – cold winter region, and hot summer – mild winter region. Analysis of each region cover the climate and its vernacular architecture with a special focus on how sustainability was addressed.
<i>The Climatic Design in Chinese Vernacular Courtyard House Settlement – A Wind Environmental Simulation</i>	Yuan Shi, Edward N. G.	2014	This study aims to discover the key points of how the same architectural form provide wind environmental adaptability in different seasons with totally opposite weather conditions; through means of CFD simulations.
<i>Adaptation of Courtyard Design of Sky Court, Chengdu in related to Local Climate to achieve Thermal Comfort</i>	Unkown author; published by ARCASIA (ARC 2213/2234 Asian Architecture)	2015	The objective of this paper mainly focuses on urban architecture; analyzing the features of courtyard enhancements based on comparison between the modern and traditional features regarding the impact on thermal comfort. Climatic factors such as sunlight exposure and its relation to the courtyard ventilation is also taken into consideration for the analysis.
<i>Research on Outdoor Thermal Environment of Lingnan Garden in Hot-humid Region, China – Taking Yu Yin Shan Fang as an Example</i>	Xue Sihan, Feng Jiacheng, Xiao Yiqiang	2015	This paper tries to seek a method to study how the traditional Lingnan garden spaces adapts to the local hot and humid climate. The study also expects to make relatively comprehensive description and analysis of climate adaptation characteristics of traditional Lingnan garden from time and space dimension respectively to make it a better inheritance in modern designs.

<i>The Effects of Courtyards on Indoor Thermal Conditions of Chinese Shophouse in Malacca</i>	Mohd Azuan Zakaria, Tetsu Kubota, Doris Hooi Chyee Toe	2015	This paper discusses the effects of courtyards on indoor thermal environment in a traditional shophouse in Malacca, Malaysia based on field measurement results. Taking into calculation local climate conditions and interior temperatures.
<i>Improvement of Ventilation and Thermal Comfort using the Atrium Design for Traditional Folk Houses – Fujian Earthen Building</i>	Ying-Ming Su	2017	This study chose two different cases (Round Atrium: Er-Yi Building, Double Round Atrium: Zhen-Chen Building) of earthen building in Fu-jian to compare the ventilation effects of different atrium forms. Data gathering used field measurements and Computational Fluid Dynamics (CFD) for temperature, humidity, and wind environment simulations.
<i>Thermal Aspect in relation to Feng Shui of the Houses in Citraland Surabaya (translated)</i>	Juan Hogianto, Christina Eviutami Mediastika	2017	This study aims to discover whether the application of <i>Feng shui</i> , especially the <i>Luo Pan</i> compass and the bathroom's position inside the bedroom affects living comfortability aspects in the houses of Citraland Surabaya. The research mainly focus on field measurements and purposive sampling questionnaires regarding the houses' temperature and humidity.
<i>Architectural Spatial Design Strategies for Summer Microclimate Control in Buildings</i>	Xiaoyu Du, Regina Bokel, Andy van Dobbelsteen	2018	The objective of this paper is to clarify the spatial design strategies used to control the microclimate of a Chinese vernacular house in summer by comparing the building with modern Chinese rural houses and presenting ideas for contemporary architectural design practice. Spatial and spatial boundary conditions, vegetations, and human activity were analyzed in order to reach the goal.

Source: Private Study, 2019

According to the aforementioned list, the topics researched includes thermal comfort, indoor thermal comfort, ventilations, vernacular Chinese courtyards and its effects to thermal comfort, *Feng shui* and its relation to thermal comfort, and design strategies for summer microclimate control. This thesis indeed has similar/related topics to the ones in the list, yet the main focus of this study is **thermal performance study of traditional Chinese buildings as a whole in Indonesia**. Since this topic has yet been researched, it can be concluded that this thesis is an authentic research conducted by the author.