Universitas Pendidikan Indonesia

COMPARISON OF INDOOR COMFORT BETWEEN WOODEN WALL CONSTRUCTION AND CONCRETE WALL CONSTRUCTION

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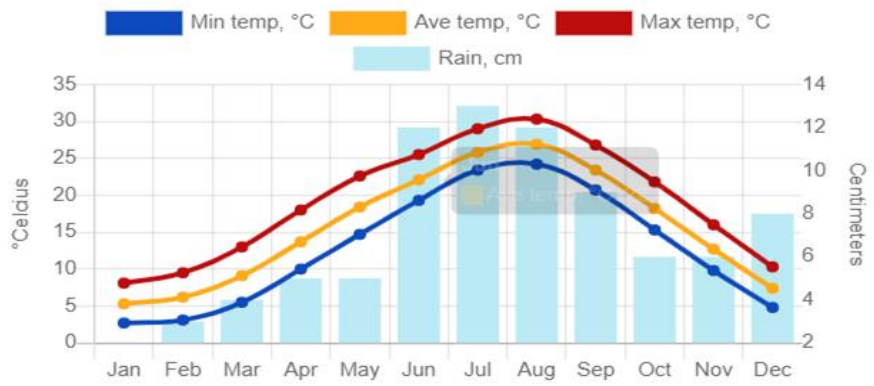
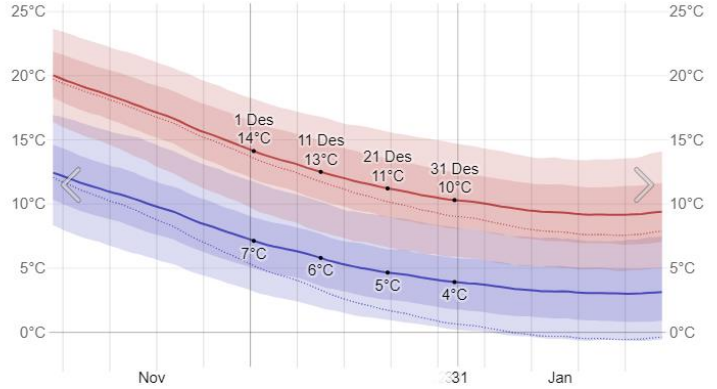
Introduction

- The construction method of assembling buildings with timber foundations, columns, beams, etc. The traditional construction method in Japan is also known as the wood structure shaft group construction method. In order to support the building with columns and beams, the rooms are characterized by flexible layout and large openings.

- Fukuoka has a subtropical climate with hot and humid summers and mild winters. During summer (June to August), temperatures can reach around 99F (37C), while winters (December to February) are relatively mild, with temperatures rarely dropping below 32F (0C). The city does, however, occasionally experience snowfall in the winter.

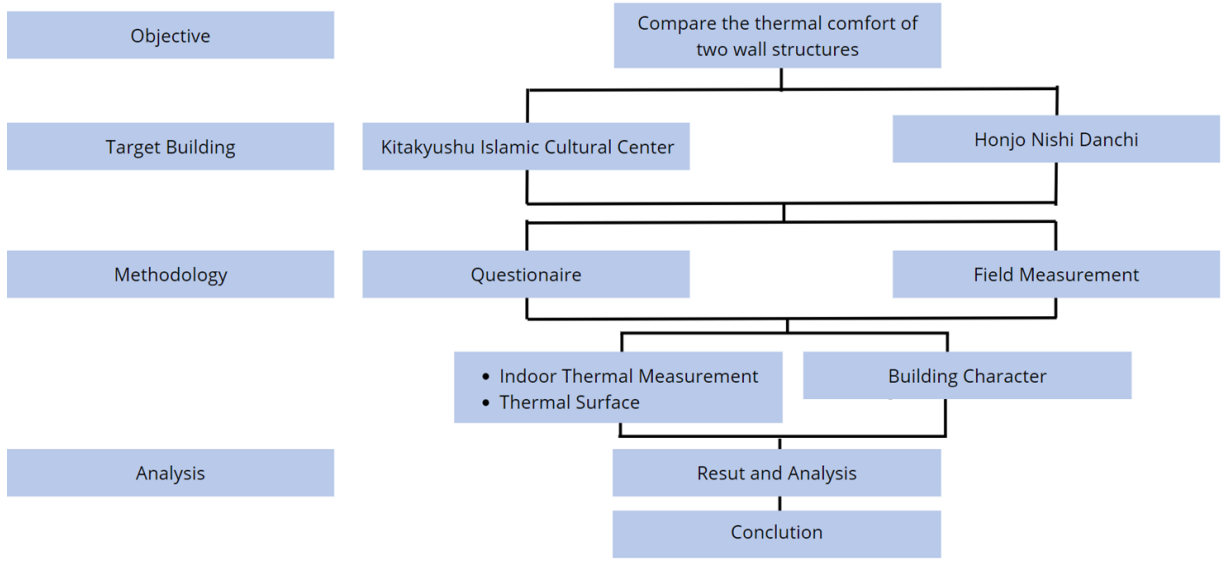




- Indoor thermal comfort pertains to the subjective perception of occupants regarding the thermal environment within a building. It reflects their satisfaction with factors such as air temperature, humidity levels, air movement, and radiant temperature.

The aim of this research is to compare the indoor thermal comfort of concrete construction walls and wooden construction walls, with a research case study of Japanese houses, Kitakyushu, Fukuoka, Japan.

Research Flowchart



Target Building

Location	17-3 Higashifutajima, Wakamatsu Ward, Kitakyushu, Fukuoka.
Building Use	Mosque
Building Area	172,98 m²
Renovation Year	2017
Structure	Wood

Location	12-15 Chiyogasaki, Yahatanishi Ward, Kitakyushu, Fukuoka.
Building Use	Apartment
Building Area	1.872,04 m²
Construction Year	1985
Structure	Concrete

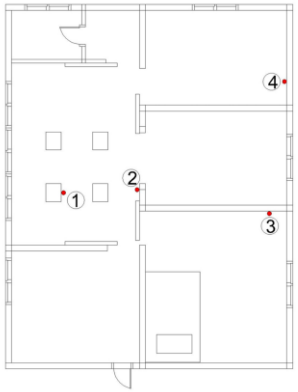
Methodology

Quesionaire

Questionnaire		
Question Contents		**Time**
Daily Lifestyle Patern	Air Conditioner daily usage	09/12/2023-10/12/2023 (10.00-10.00)
	Indoor Comfort	
Indoor Thermal Amenity	Thermal, Humidity	09/12/2023-10/12/2023 (10.00-10.00)

Measurement Plan

1. Cat Room
2. Kitchen
3. Living Room
4. Work Space



1. Living Room
2. Kitchen
3. Bed Room
4. Shower

Measurement Item

	Meas. Item	Meas. Tools	Simbol	Room	Interval
All Day Meas.	1. Indoor Temperature and Humidity meter	Small temp. and Humidity meter	●	1,2,3, and 4	10 Mins
Detailed Meas.	2. Temperature Surface	Laser Temperature Surface		1,2,3, and 4	

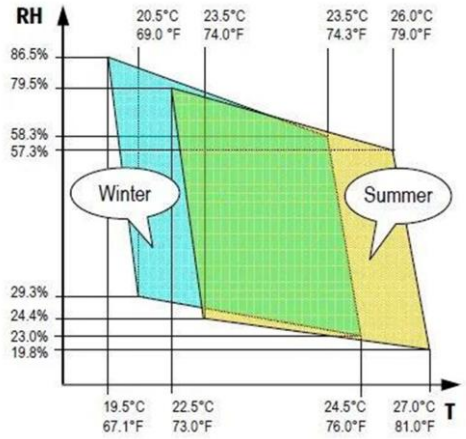
Laser Infrared Surface

Thermo Recorder

Measurement Period

Date	09/12/2023													10/12/2023										
Time	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	00.00	01.00	02.00	03.00	04.00	05.00	06.00	07.00	08.00	09.00	10.00
All Day Meas.	←																								→
Detailed Meas.	●																								●

Result and Analysis

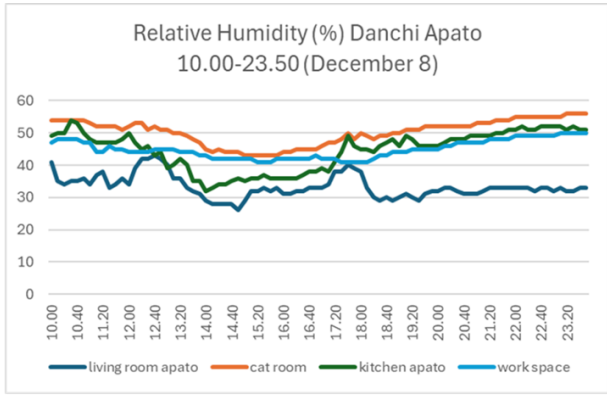


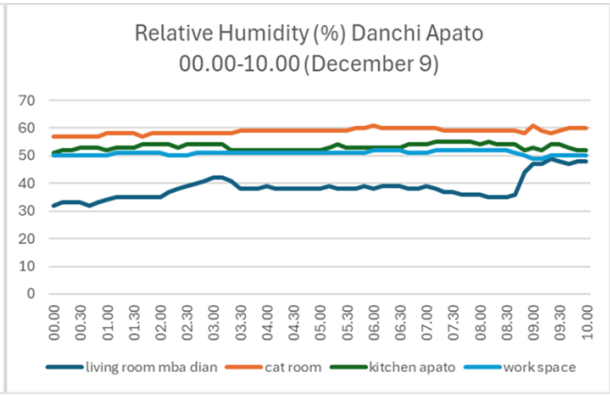
Body temperature

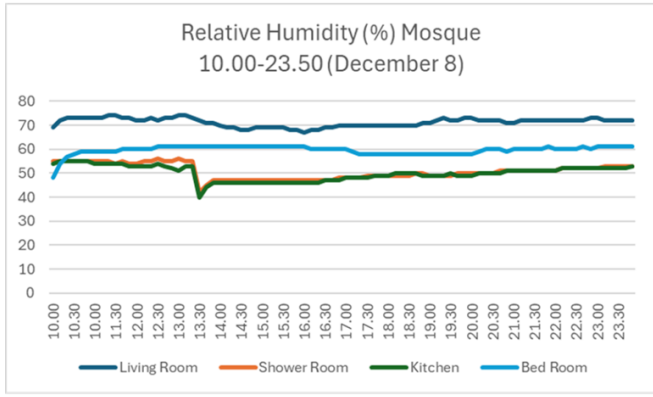
-35 ~ -10 degrees extremely cold
-10 ~ 17 degrees cold
18 ~ 25 degrees comfortable
26 ~ 40 degrees hot
41 ~ 50 degrees extremelyhot

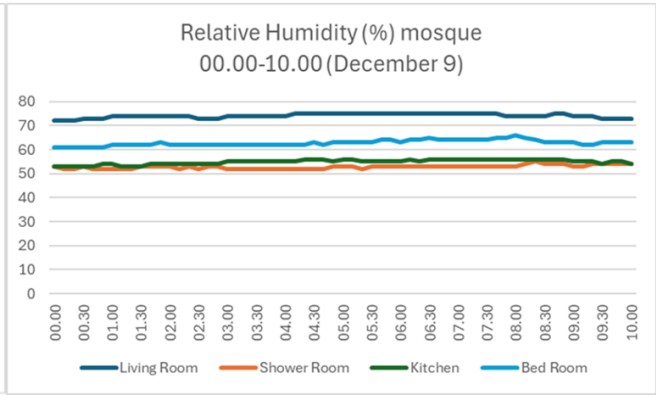
humidity

20~44% dry
45~65% comfortable
66~100% moisture









Result and Analysis

Temperature of Surface (°C) in Mosque							
NO	Room	Ceiling	Material	Wall	Material	Floor	Material
1	Bed Room	17.3	Wood	15	Wood	14.5	Luminited Wood Floor
2	Kitchen	8.5	Wood	12.6	Wood	10.8	Luminited Wood Floor
3	Living Room	10.8	Wood	9.5	Wood	13.9	Carpet
4	Shower Rooom	7.4	Wood	8.6	Wood	9.1	Luminited Wood Floor

Temperature of Surface (°C) in Danchi Apato							
NO	Room	Ceiling	Material	Wall	Material	Floor	Material
1	Cat Room	15	Asbes	15.6	Concrete	16.8	Luminited Wood Floor
2	Kitchen	16.8	Asbes	14	Concrete	17	Luminited Wood Floor
3	Living Room	20.3	Asbes	20.6	Concrete	20.2	Carpet
4	working Space	17.3	Asbes	19.6	Concrete	18.1	Tatami

Outdoor temperatures, as we know, in winter in December when the lowest temperature is measured can reach 6 degrees Celsius. However, the room temperature in wooden construction buildings without using air conditioning is able to maintain this temperature because wooden construction is also able to prevent cold weather from entering from outside to the inside.

Conclution

The conclusion of the difference in indoor humidity between Kitakyushu Islamic Cultural Center (wooden building) and Honjo Nishi Danchi (concrete building) is:
The warmth between wood and concrete can be expressed that wood resists cold weather from outside from entering inside, and concrete more quickly conducts cold from entering inside.

From the thermal calculations, we measured the thermal humidity for the warmest "living room" in the Honjo Nishi Danchi concrete building because several factors influence it.

1). There are lots of things in the room
2). Items such as warm fabrics and a television that is on can affect the warmth of the room as well
3) This is a very important factor, namely air conditioning heating.

However, the use of wooden construction is not only able to prevent cold weather from entering from outside to inside, but its use is also highly considered in terms of sustainability and efficiency in the construction industry.

Reference

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[2] J. Švajlenka and M. Kozlovská, “Evaluation of the efficiency and sustainability of timber-based construction,” J Clean Prod, vol. 259, Jun. 2020, doi: 10.1016/j.jclepro.2020.120835.

[3] A. Klemm and D. Wiggins, “12 - Sustainability of natural stone as a construction material,” in Sustainability of Construction Materials (Second Edition), J. M. Khatib, Ed., Woodhead Publishing, 2016, pp. 283–308. doi: https://doi.org/10.1016/B978-0-08-100370-1.00012-3.