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Optimizing Winter Indoor Comfort: A Comprehensive Analysis of Thermal Perfomance in CLT Building- A Case Study on Meldia Research Institute For Advanced Wood

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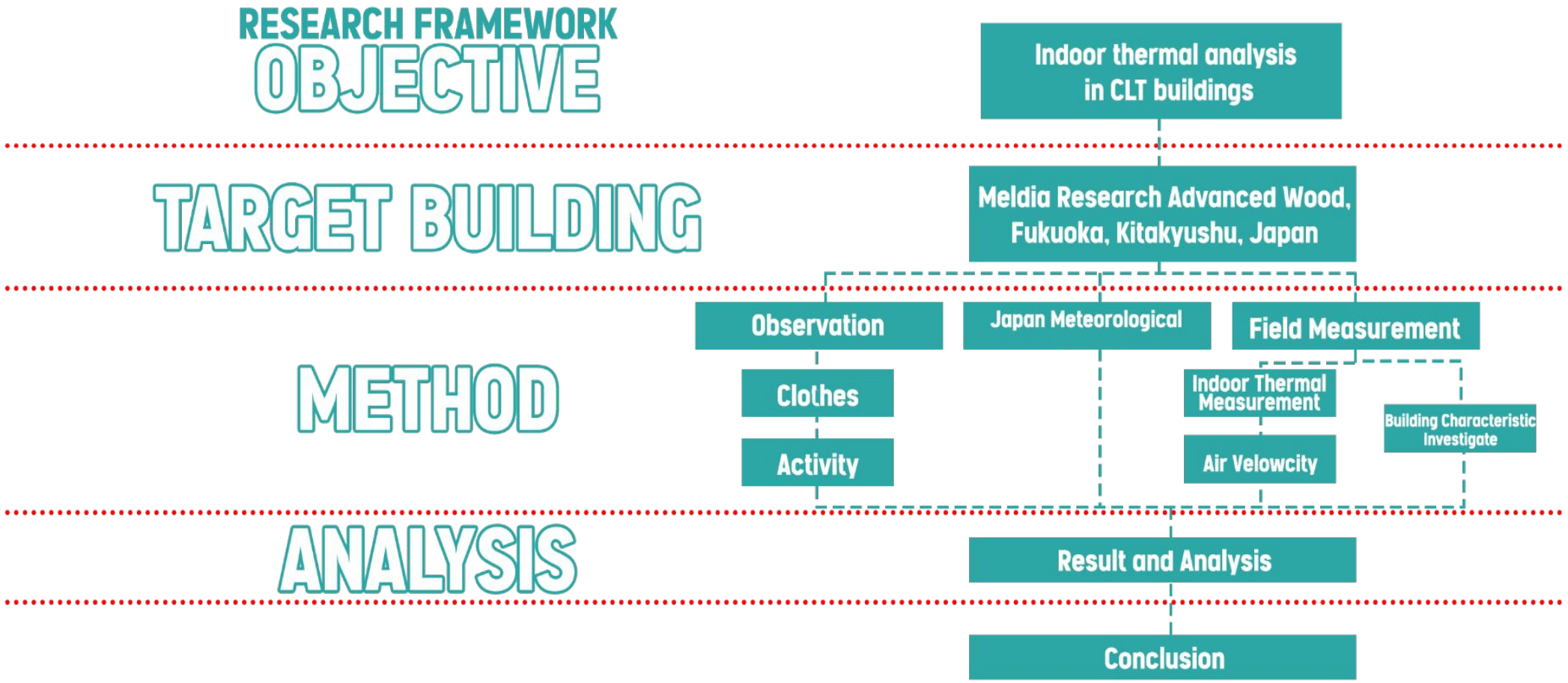
1. Introduction

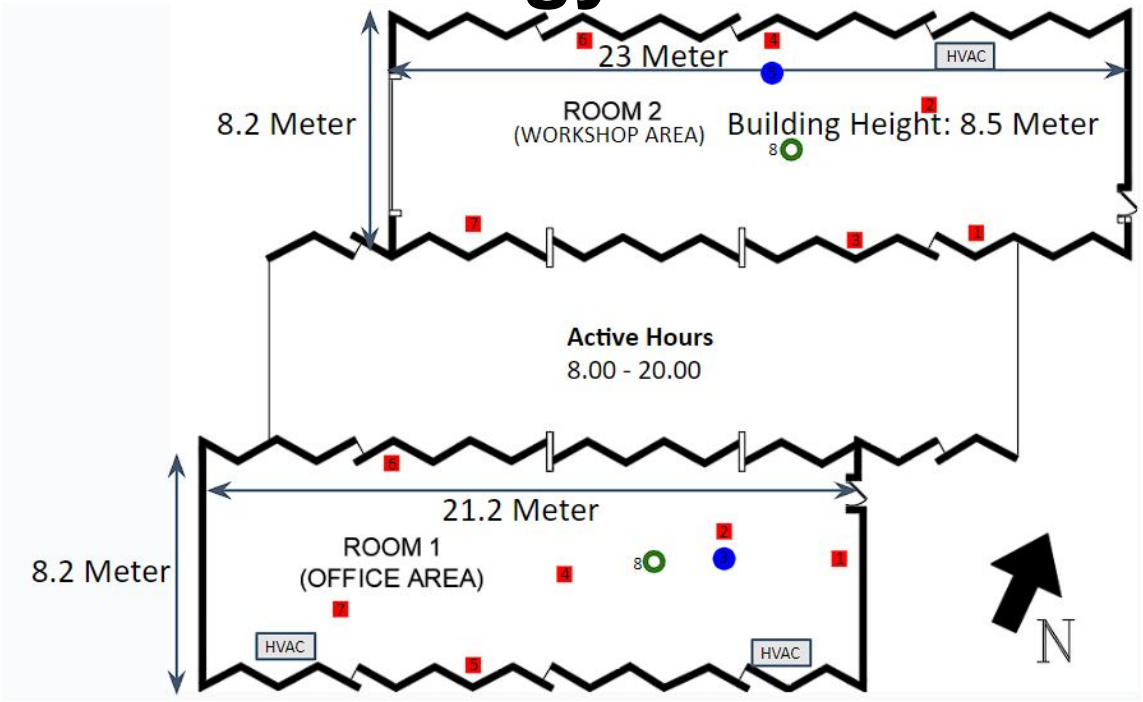
1. **Cross laminated timber,** As one of the advancements in the development of processed wood materials, CLT provides major benefits in terms of lowering construction's carbon footprint.
2. **Japan weather Condition,** January and February in Fukuoka, Japan, have the lowest recorded average wintertime air temperatures. The daily maximum temperature at this time was 9°C, with an average temperature of 3°C.
3. **Thermal Comfort,** Measuring thermal performance is also related to thermal comfort which can be defined as the physical condition of the body that is better than the physical condition of the environment.

The aim of this research is to measure and review indoor thermal comfort of CLT building during winter, with the case study Meldia research Advanced wood, Fukuoka, Kitakyushu.

Research Framework



2. Methodology



	Meas. Item	Meas. Tools	Symbol	Room	Interval
All Day Meas.	1. Indoor Temperature and Humidity meter	Small temp. and Humidity meter	■	1 and 2	10 Min
	2. Globe Thermometer	Globe Thermometer	●	1 and 2	10 Min
Detailed Meas.	3. Wind Velocity	Anemometer	○	1 and 2	2 Hours

2.1 Observation

Building Equipment	Ownership HVAC
Activity	What activities are carried out
Clothes	What clothes do you wear

2.2 Field Measurement

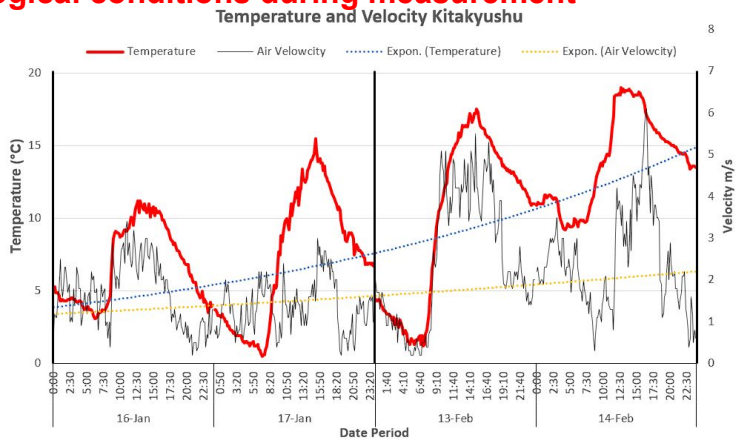
Date	16-Jan	17-Jan	13-Feb	14-Feb
All Day Meas.	←	—	—	→
Detailed Meas.	●	—	—	●


Globe Thermometer


Small temp. adn Humidity Meter


Anemometer

2.3 Meteorological conditions during measurement



3. Result and Discussion

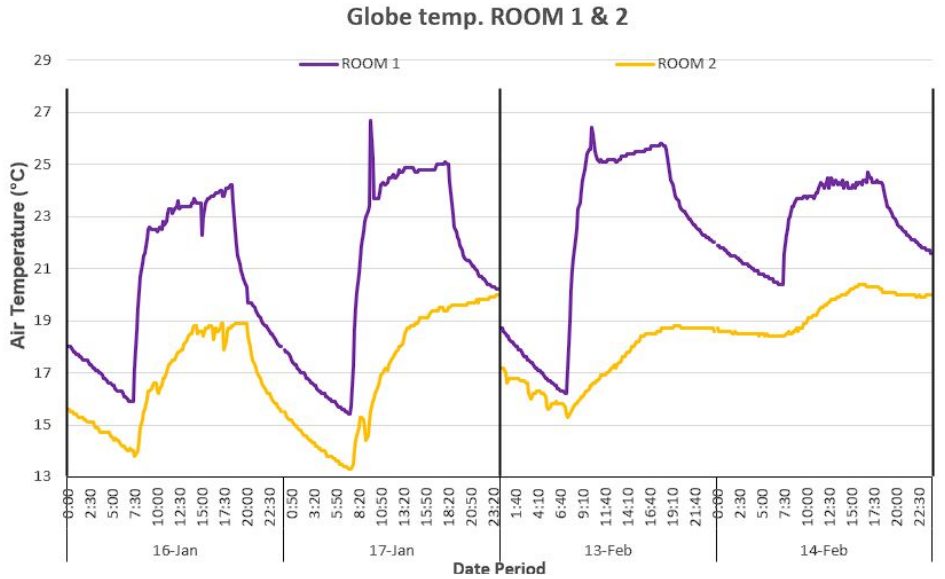
3.1 Observation Result

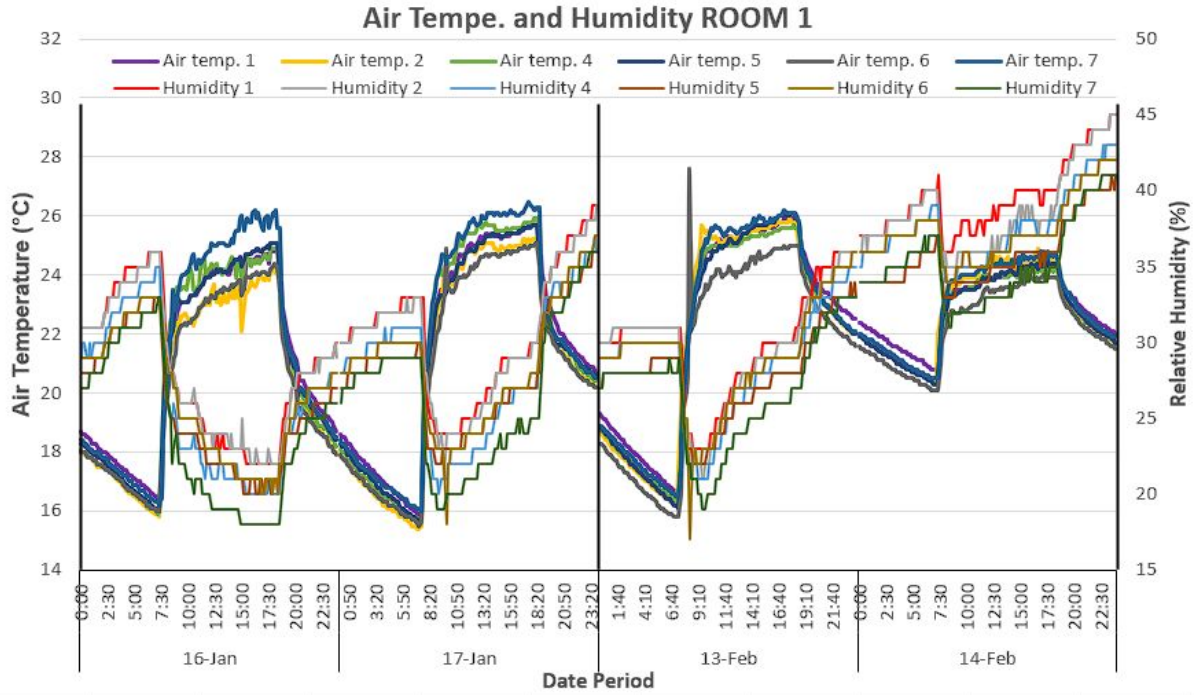
Building have two Function:

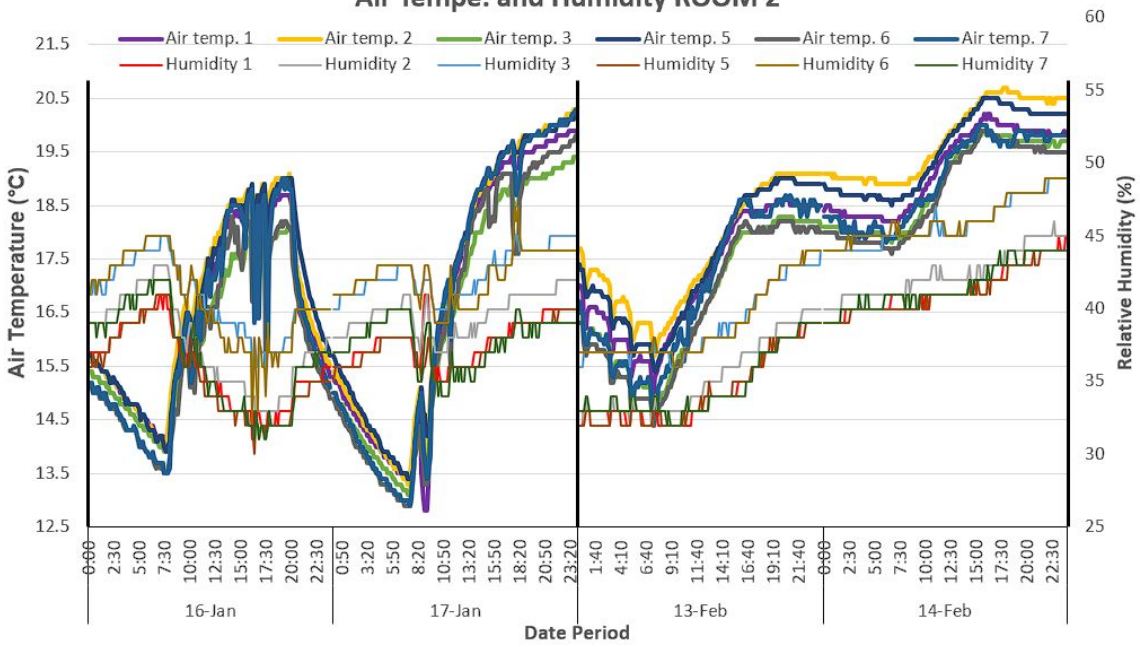
- **Office**
  Aticity: Typing= 65 Met
  Clothes: Insulated Coveralls= 1.37 clo
- **Workshop area**
  Aticity: Saw Work= 105 Met
  Clothes: Insulated Coveralls= 1.37 clo
- Each Room Have **HVAC**

3.2 Field Measurement Result

- Air Temperature
- Relative Humidity
- Comparison Temperature Top and Bottom

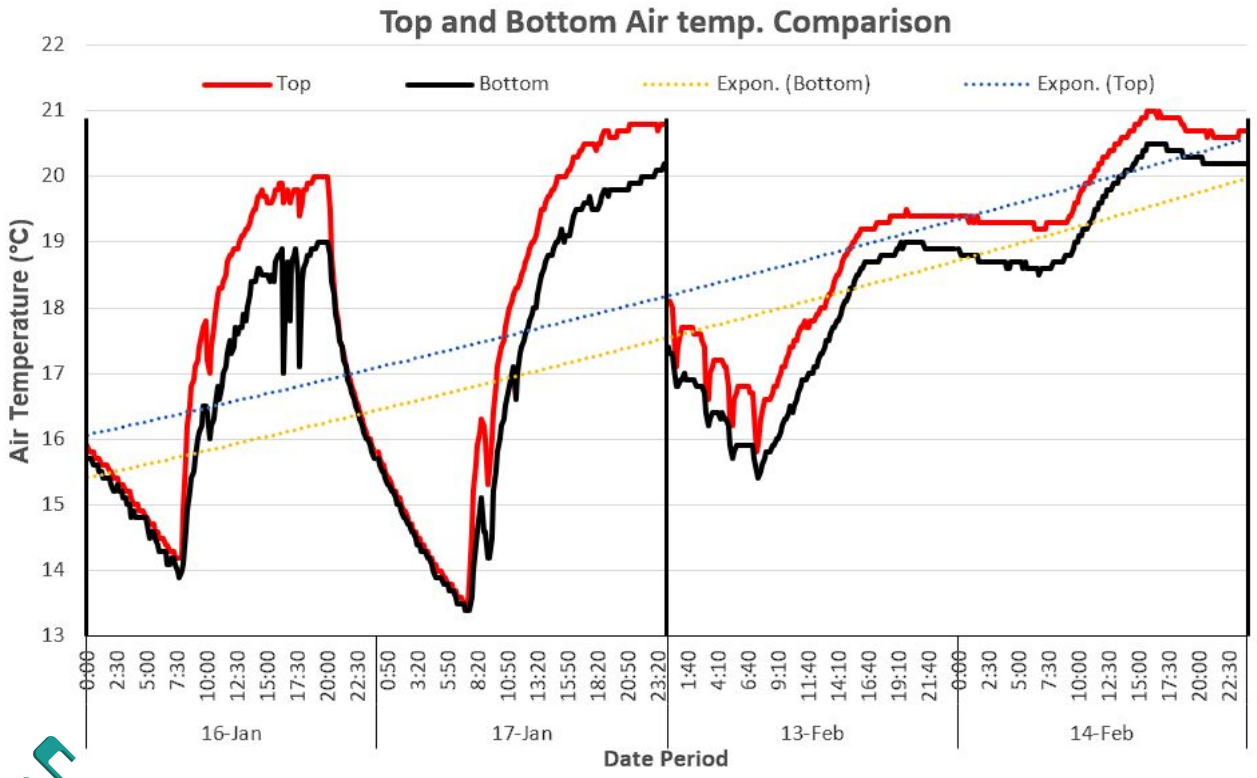


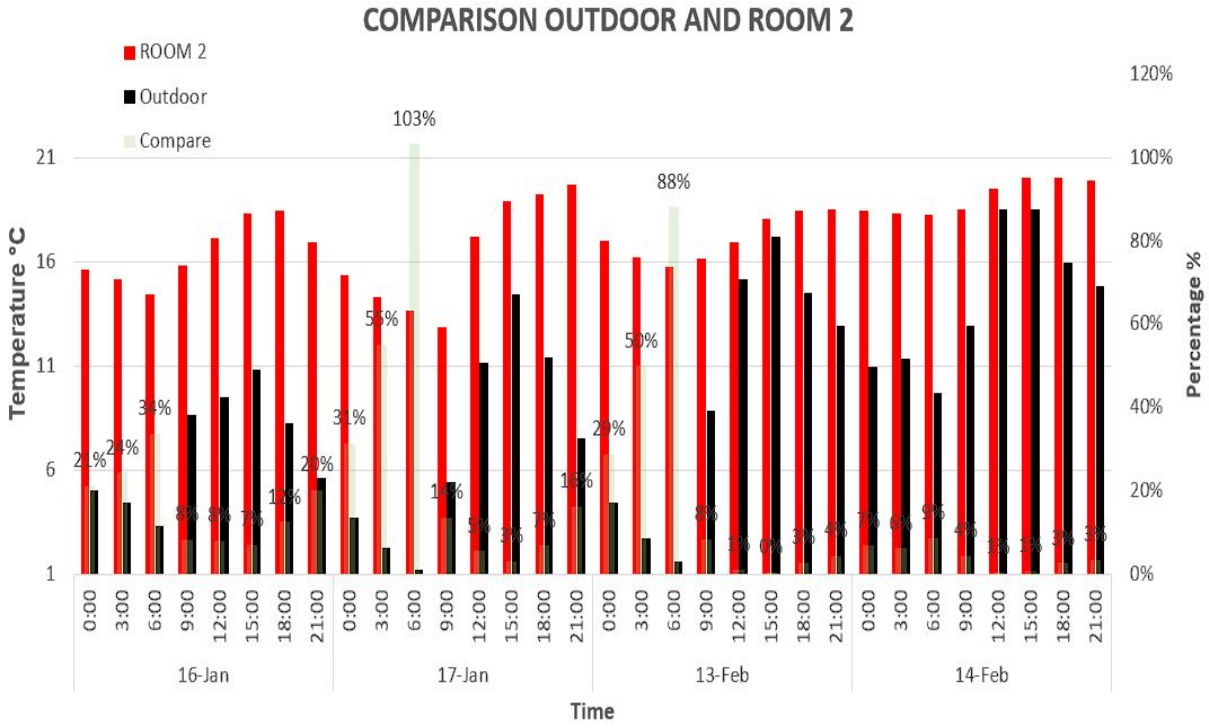




3. Result and Discussion

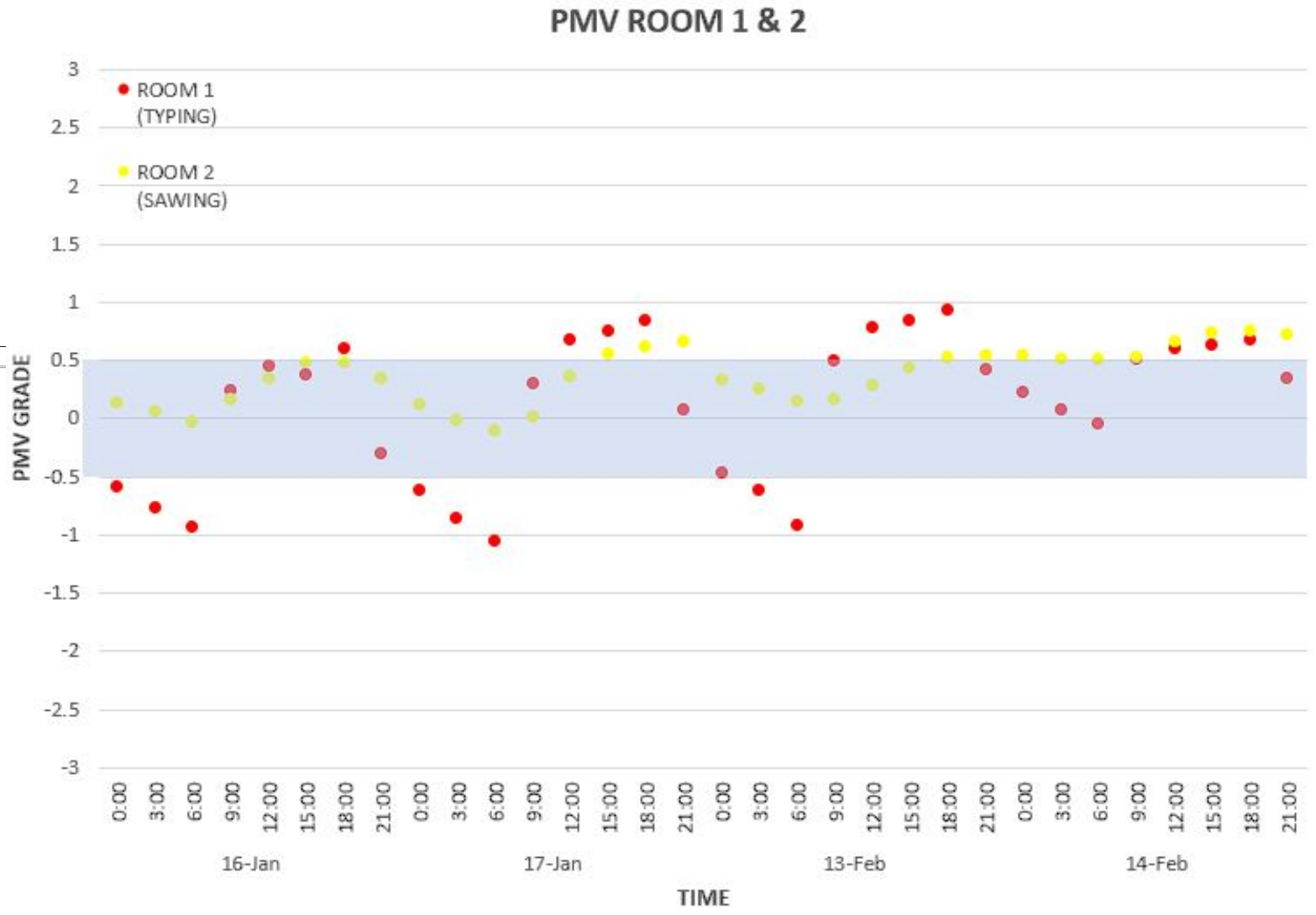
3.3 Comparison Measurement Analysis





4. PMV Analysis

PMV	Thermal Sensation	PDD (%)
+3	Hot	100
+2	Warm	75
+1	Slightly Warm	25
0	Neutral	5
-1	Slightly Cool	25
-2	Cool	75
-3	Cold	100



5. Conclusion

- The measurement results show that areas **far from ventilation and entrances** have **comfortable temperature conditions for carrying out activities**, because air can go in and out through these openings.
- The use of HVAC and skylights in this CLT building , **results in a top and bottom temperature difference of 0°C -2.6°C**, it is recommended to minimize the use of HVAC and skylights so that the temperature difference can be reduced.
- The PMV results for room 1 during working hours are **above +0.5**, so it is recommended **to reduce the HVAC temperature from 22°C to 20°C.**

6. Reference

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