



Bandung
Institute of
Technology

Investigating outdoor thermal comfort in Hot Humid Public Spaces: A Case Study of Alun-Alun Bandung.



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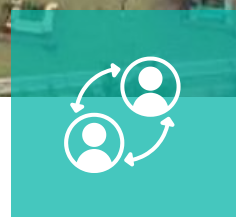


International Symposium and Workshop
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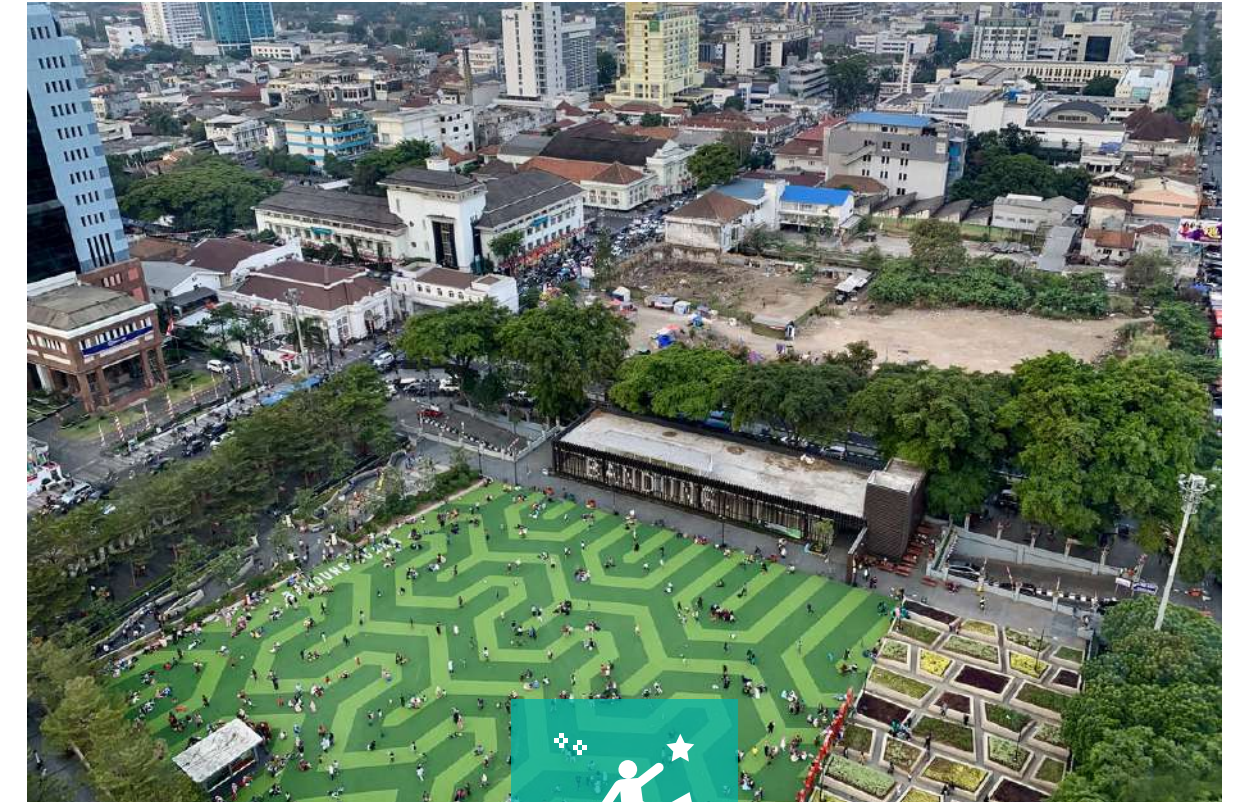
Introduction



engage, gather or any **social activities**



Adjustments in microclimate in outdoor spaces have a significant impact on the thermal comfort of visitors.

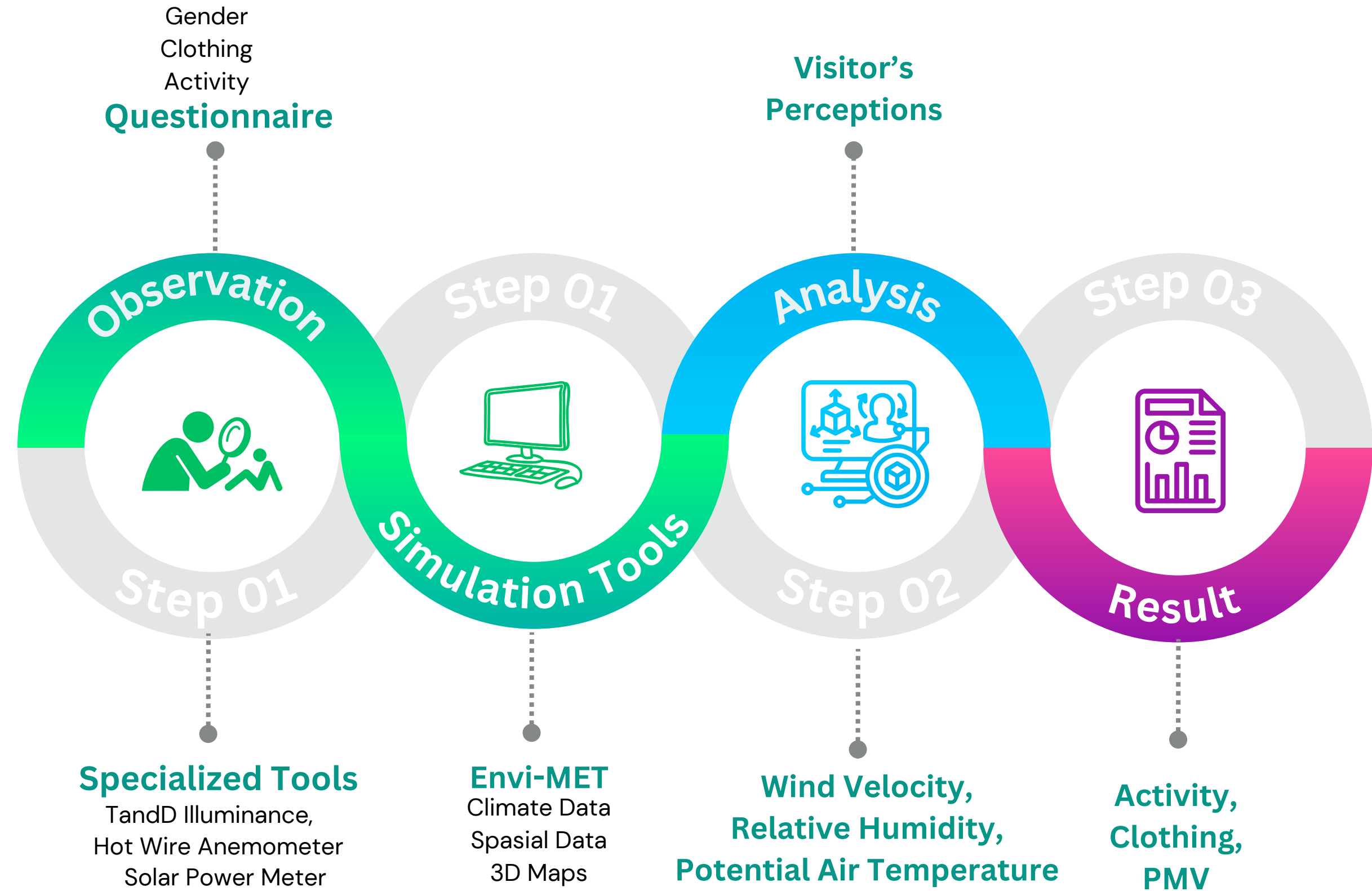


Assess visitors' level of thermal comfort experienced in public areas in Alun-alun Kota Bandung and its surroundings

Investigates the reason behind the thermal comfort experienced by visitors in Alun-Alun Kota Bandung's public areas



Methodology





Location



- ① Center
- ② Shaded by Trees
- ③ Shaded by Building
- ④ Labyrinth area



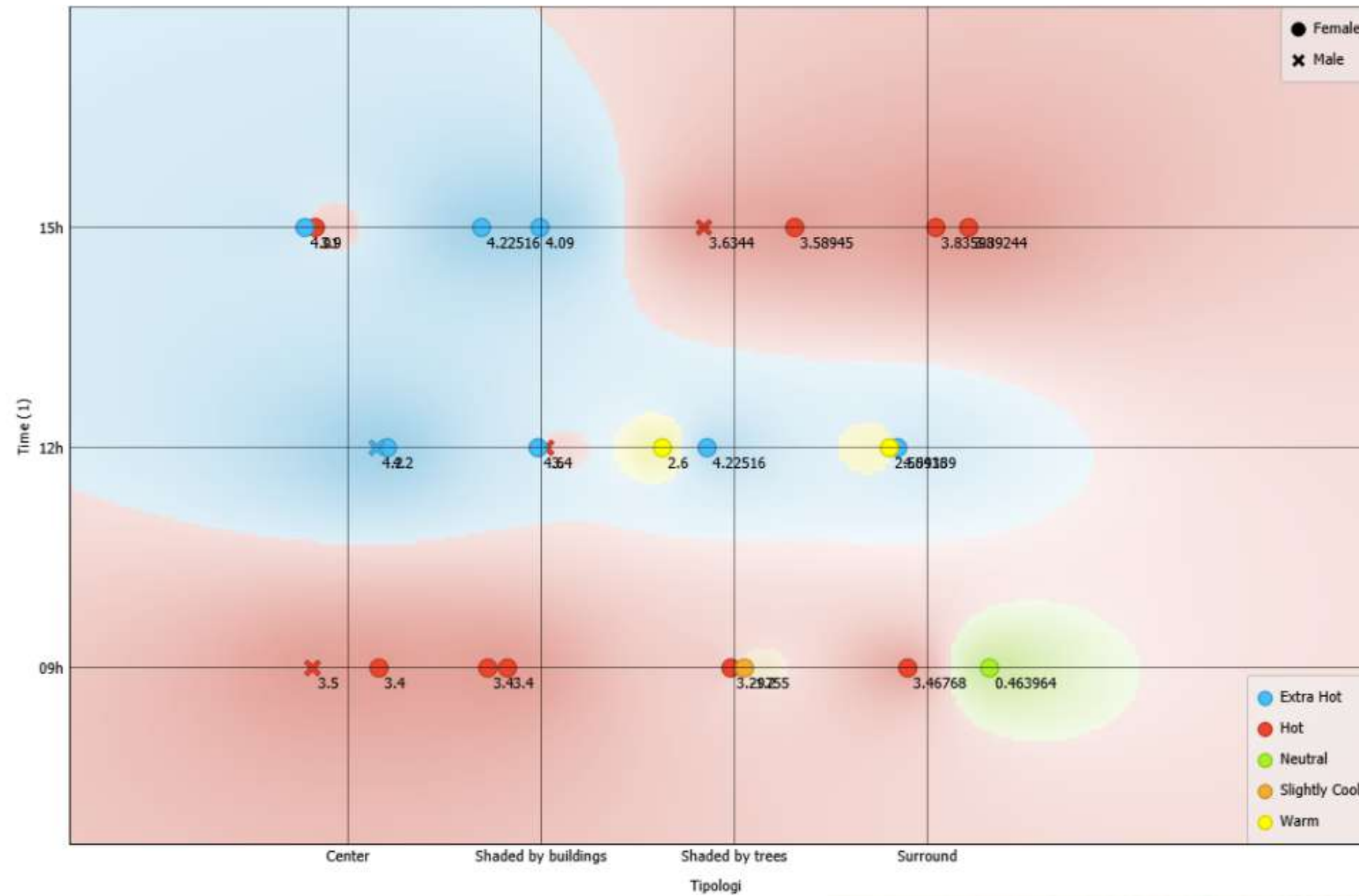
The categories:

- Slightly Cool : $-1 > PMV > 0,5$
- Neutral: $-0,5 > PMV > 0,5$
- Warm: $-1,5 > PMV > 2,5$
- Hot & Extra Hot: $PMV > 3$



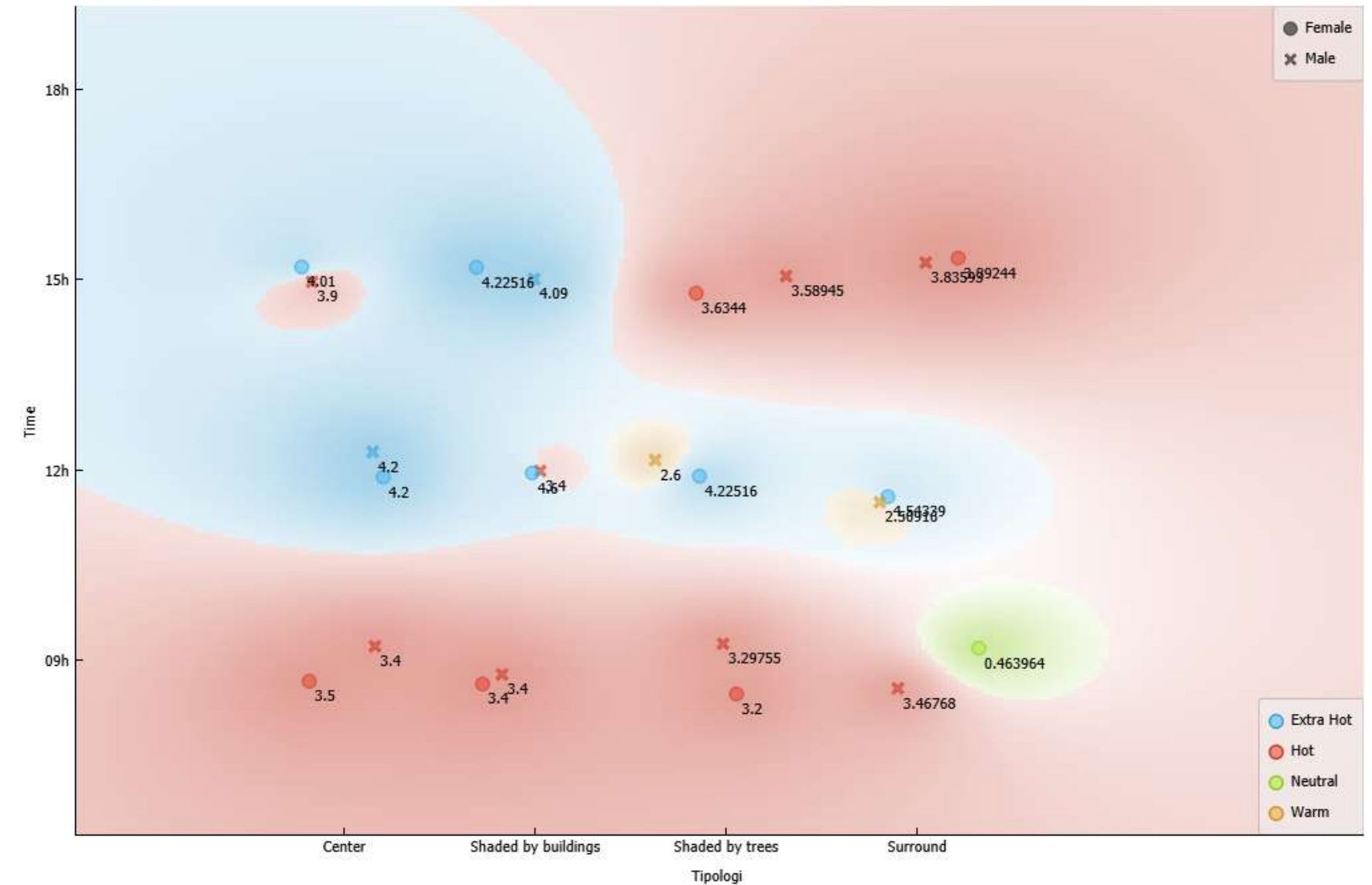
Result

PMV based on Observation



Graphic shows the responses obtained from interviews with respondents, such as sample locations, color of clothing during the weekday and weekend, are overlaid.

Envi-MET results on PMV



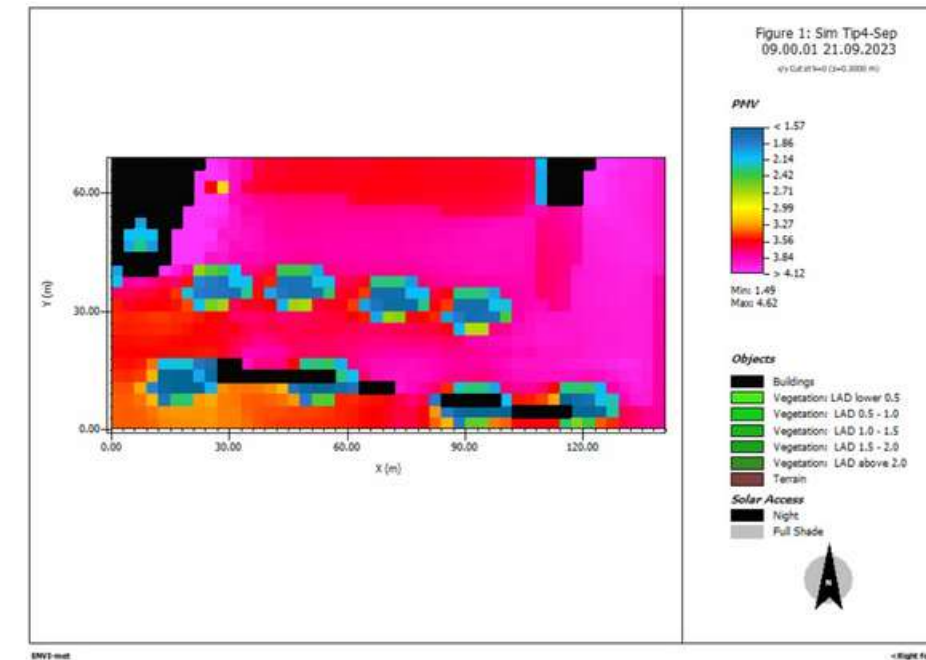
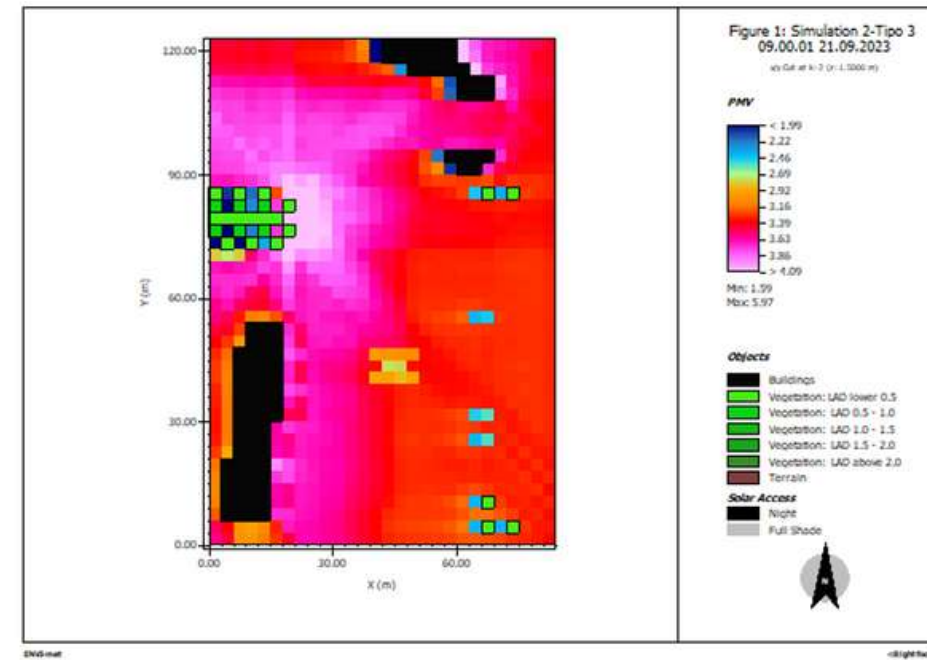
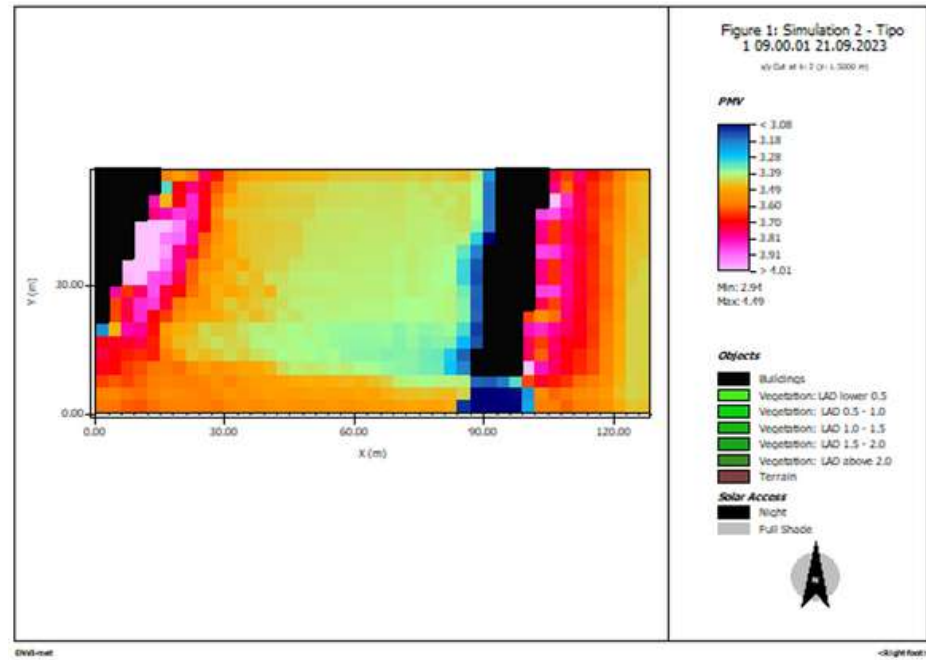
Graphic shows overlay results comparison between the PMV analysis and ENVI-met simulation. The perception value of thermal comfort carried out at the research location through the two mediums yields a difference in PMV categories.

Result

Typology 1

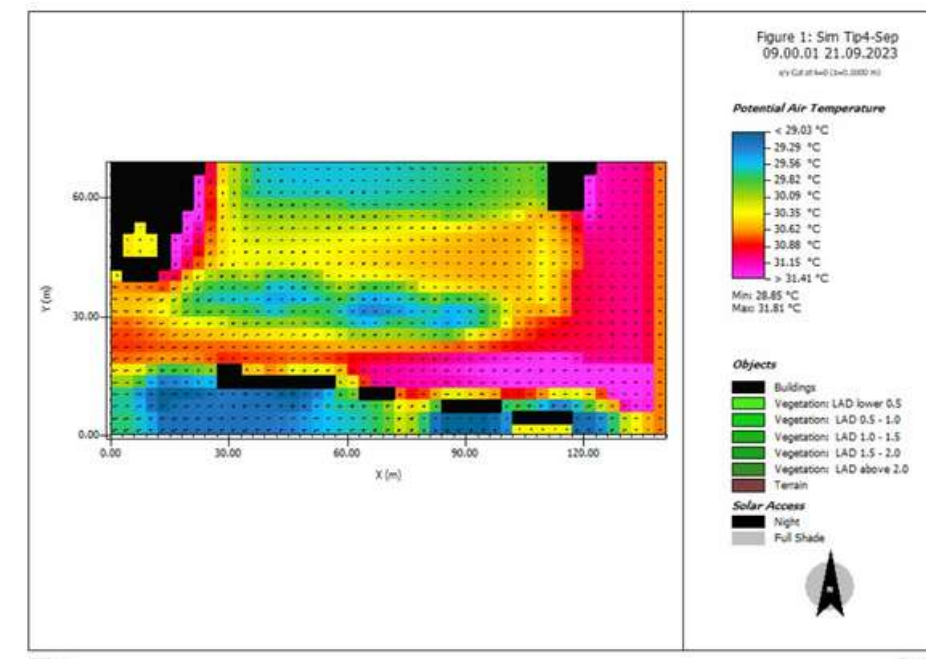
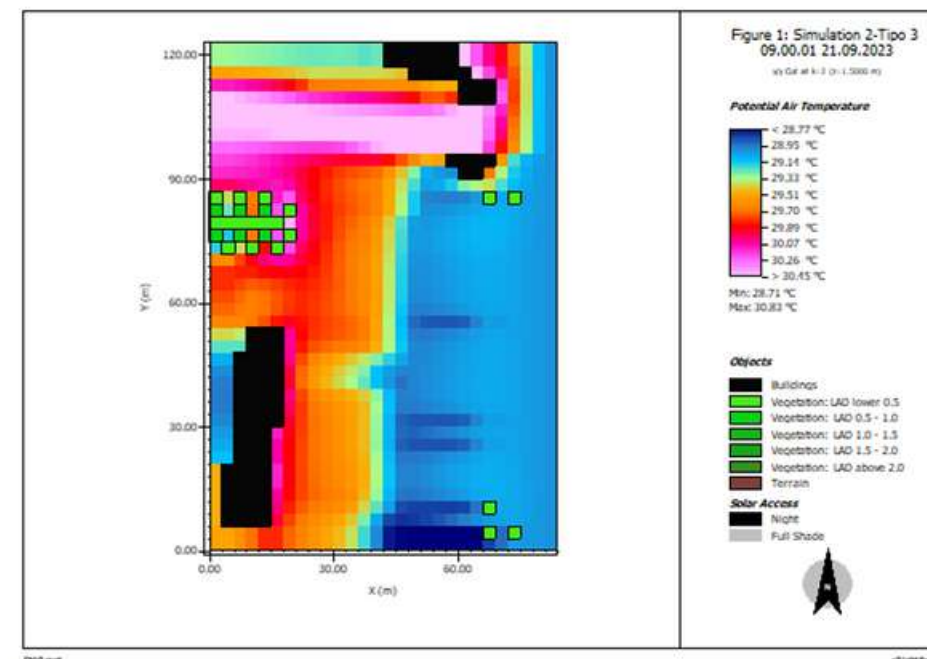
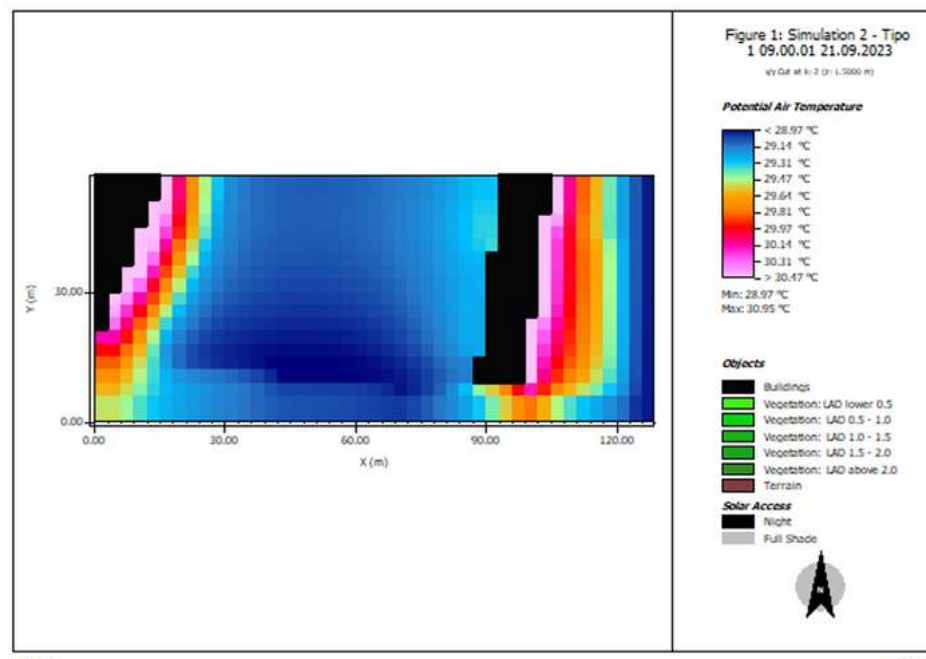
Typology 3

Typology 4



09.00 AM

Predicted Mean Voted

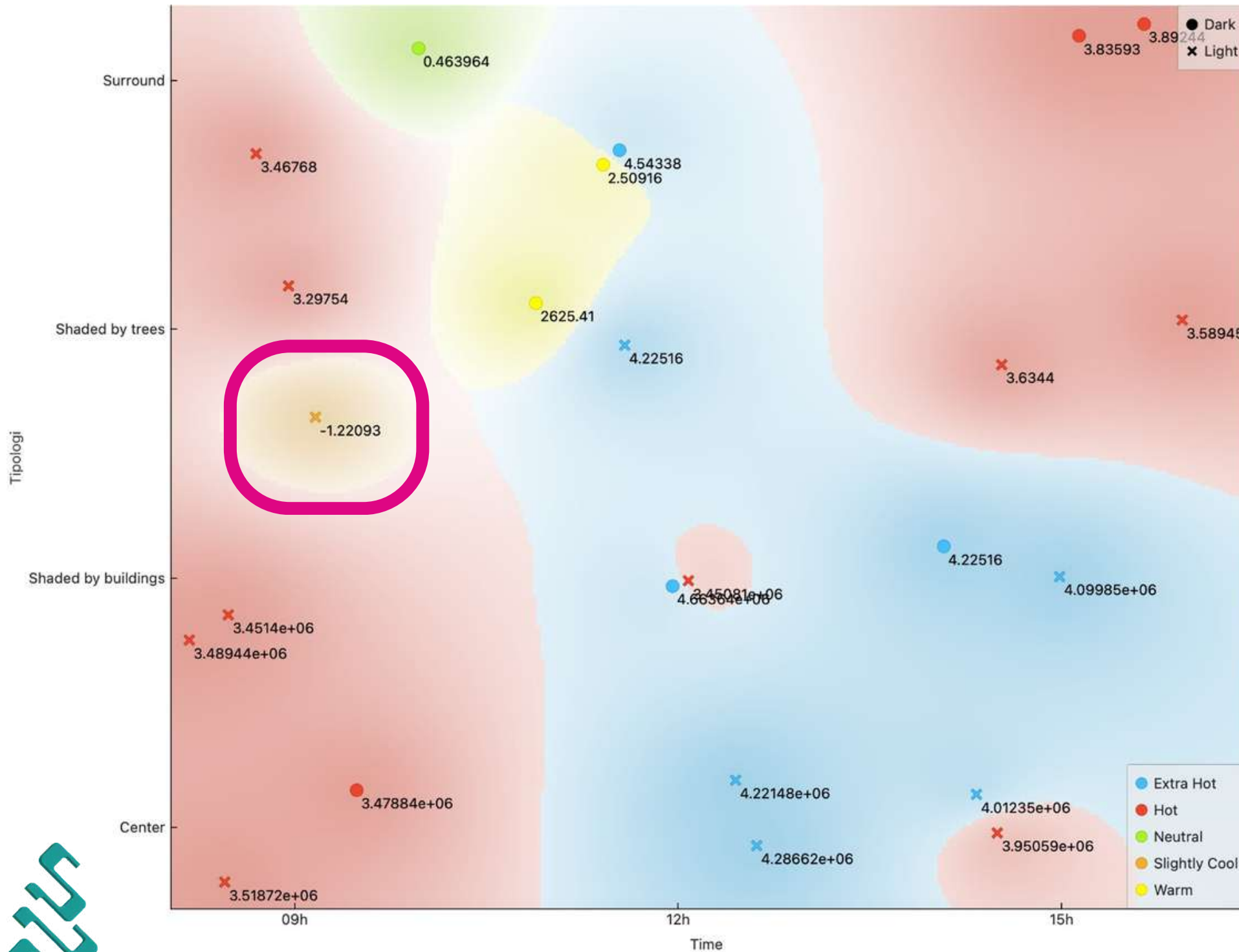


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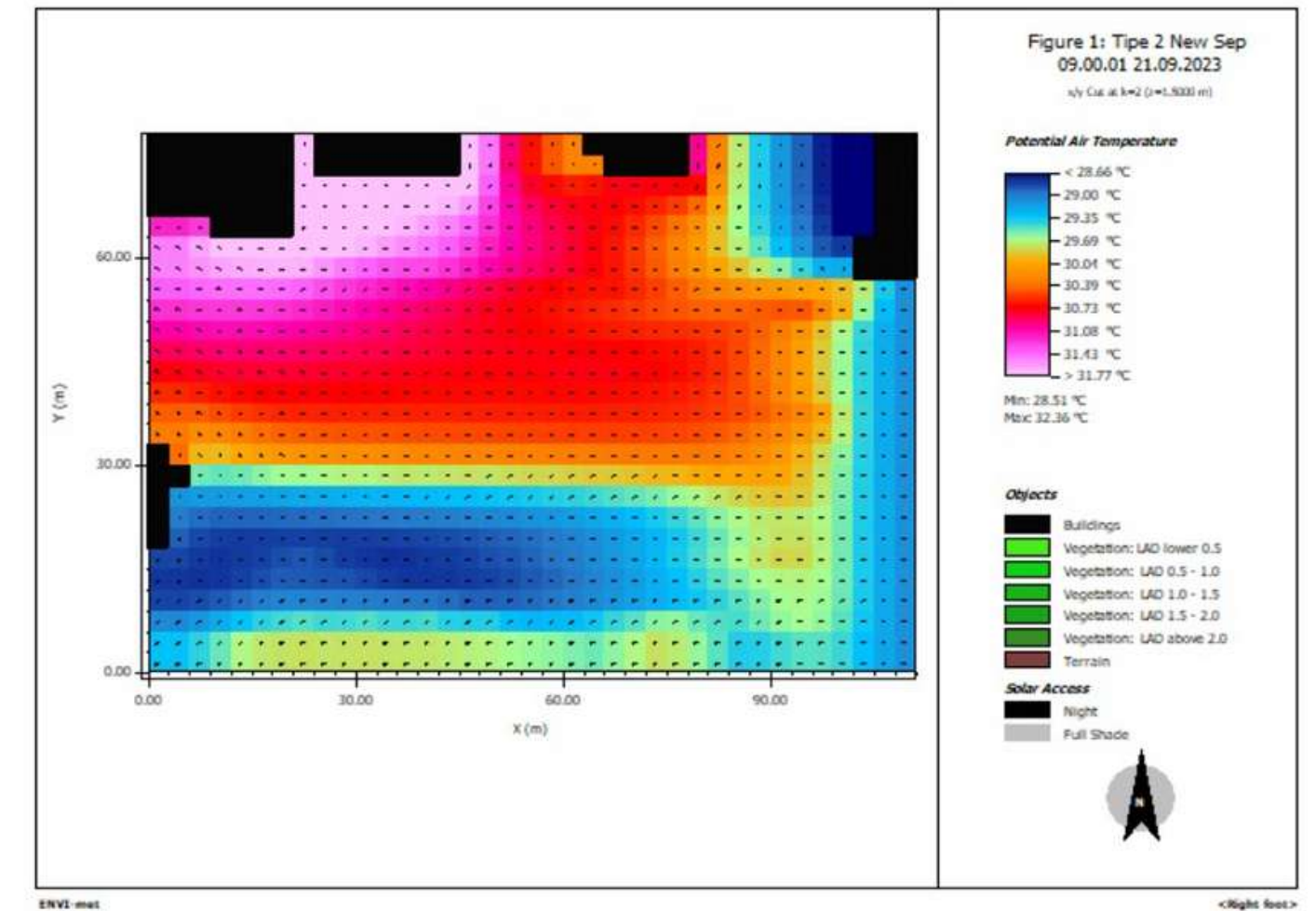
Potential Air Temperature

Result > temperature as one of factor that influences outdoor thermal comfort in different typologies shown by ENVI-met simulation results.

Discussion



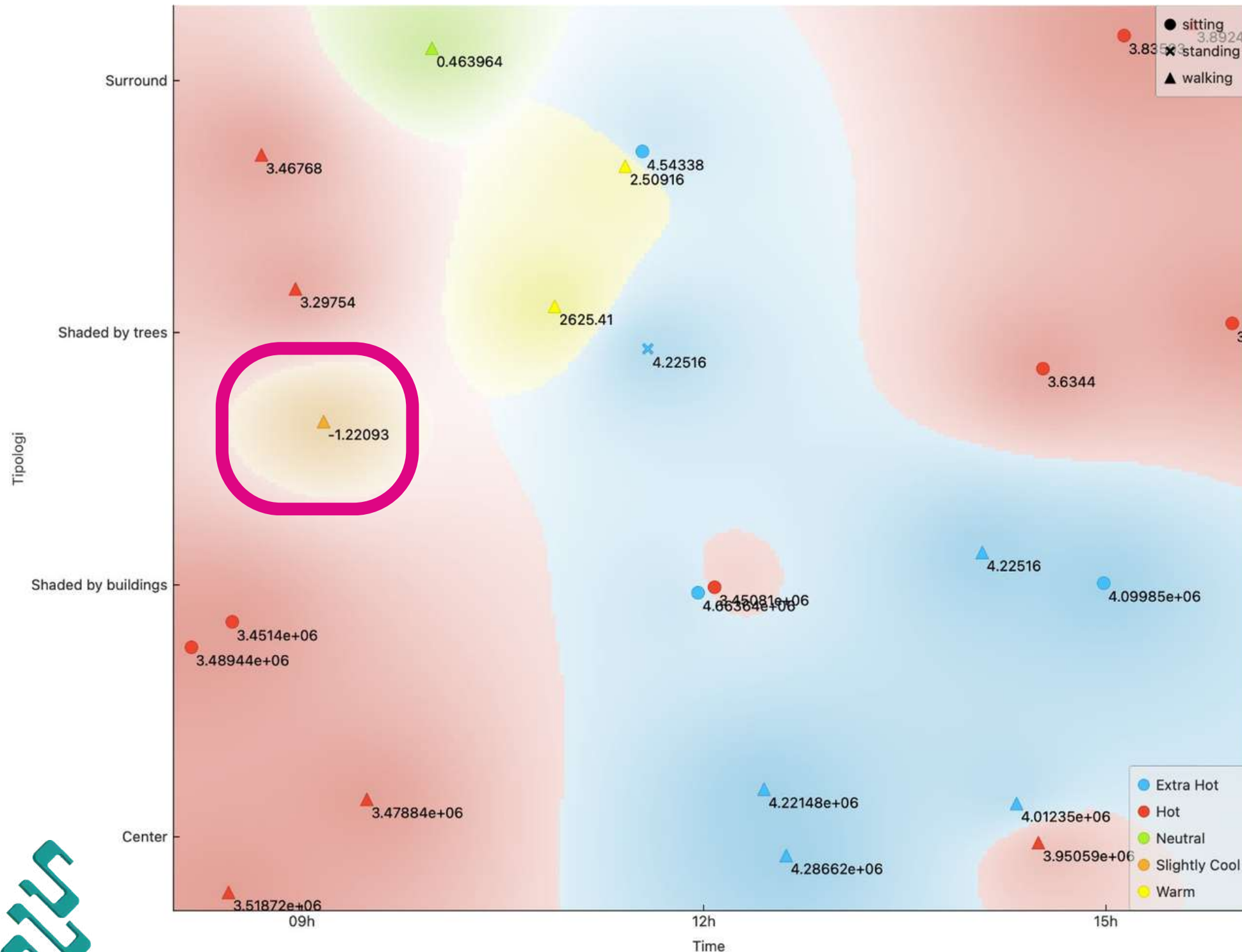
Typology 2



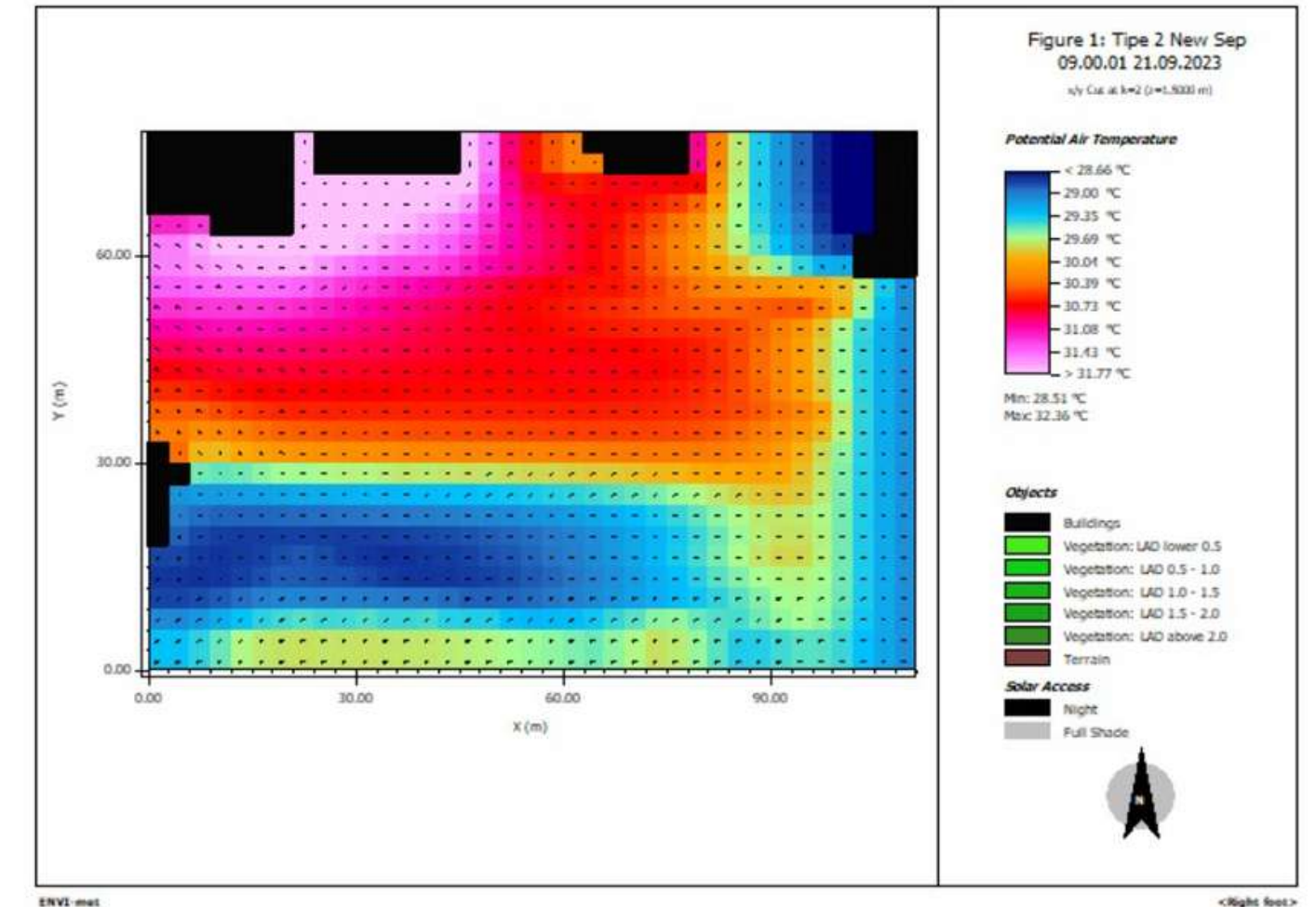
09.00 AM Potential Air Temperature

Thermal comfort which changed based on clothing are shown in these pictures, at some point visitors will feel comfortable at certain typologies. In this case visitors feel slightly cool during their activities in typology 2.

Discussion



Typology 2



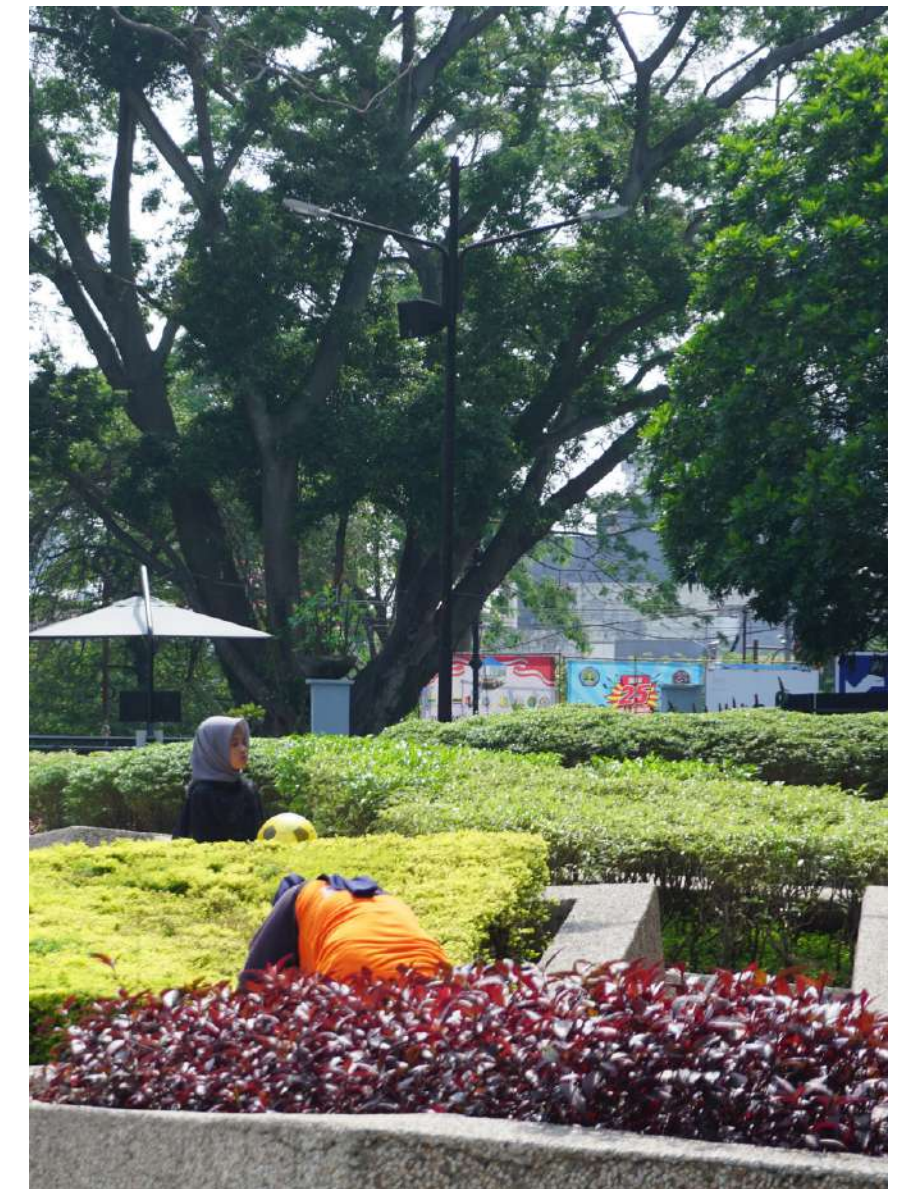
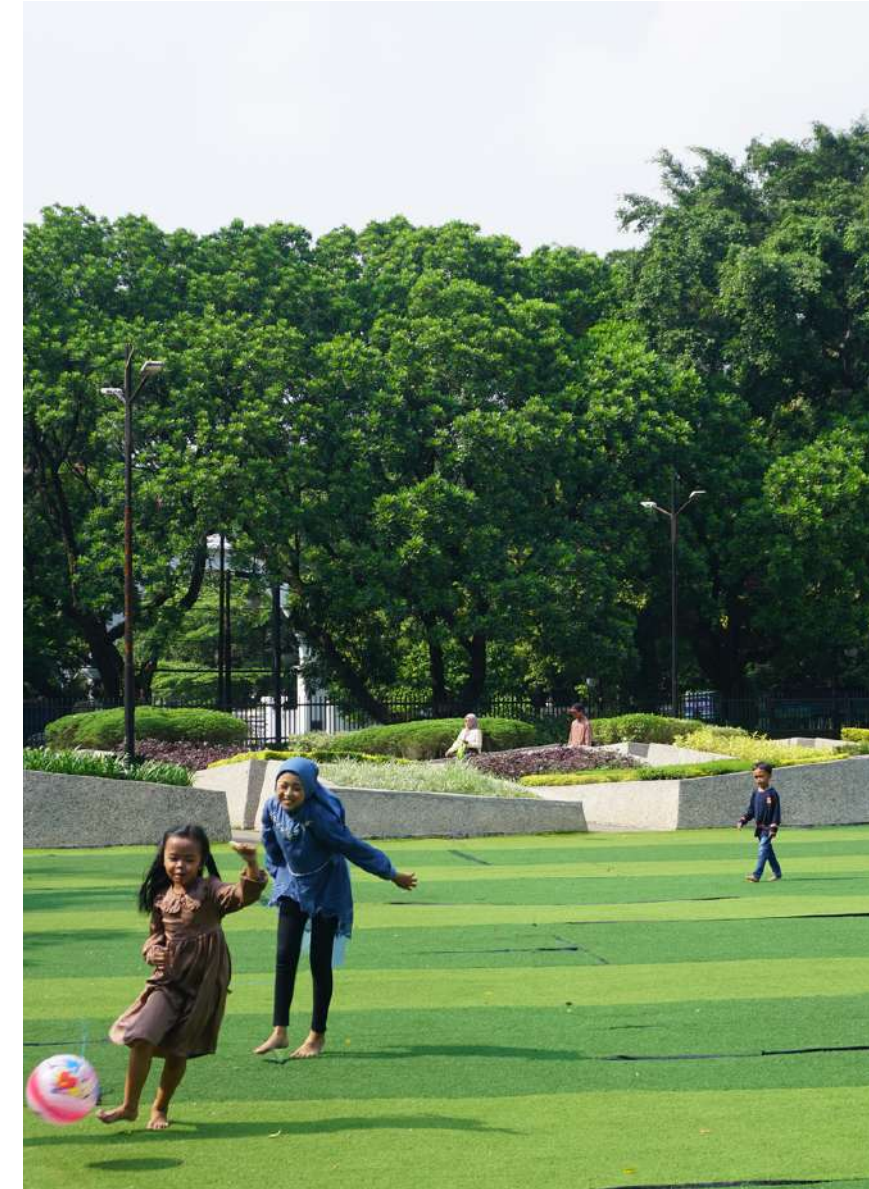
09.00 AM Potential Air Temperature

Based on their activities, it can be concluded that visitors more likely comfortable doing any social interaction in typology 2 and 4 which has vegetation or surrounded by tall trees.



Closing

- 1 Microclimate condition in Alun Alun Kota Bandung are varies across the typologies based on sample locations decided. Types of land cover classification also play part on defines the conditions.
- 2 Alun Alun Kota Bandung is categorized as generally warm based on direct observation and ENVI-met analysis. Otherwise, there were specific areas showcased that identified as slightly cool and neutral where vegetation is present or in areas shaded by trees.
- 3 This research ended up with 2 suggestions to enhance the microclimate conditions for pedestrian thermal comfort:
 - provide more shade-giving trees
 - to use environmental-friendly materials that do not reflect sunlight.



References

- Klemm, et.al. (2014). *Psychological and Physical Impact of Urban Green Spaces on Outdoor Thermal Comfort During Summertime in The Netherlands*. *Journal of Building and Environment* xxx (2014) 1e9.
- Lin, Tzu-Ping. 2009. *Thermal perception, adaptation and attendance in a public square in hot and humid regions*. *Journal of Building and Environment* 44 (2009) 2017–2026.
- Yang, Wei (2013). *Thermal comfort in outdoor urban spaces in Singapore*. *Journal of Building and Environment* 59 (2013) 426e435.