International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

A Simulation Analysis of the Right to Sunlight in Accordance with Taiwan's Building Technical Regulations

Spring C. Hsu
Associate Professor, Department of Architecture, China University of Science and Technology, Taipei City, Taiwan
Email address: clhsu@cc.cust.edu.tw

***Abstract*—*In the context of rapid urban development, the right to sunlight has become a key issue in architectural design. This issue is related to the quality of life of residents and the environmental conditions of public spaces. The construction or expansion of buildings often affects sunlight conditions in the surrounding area, causing concerns about quality of life. To safeguard public interest, many regions have introduced building technical regulations to protect the right to sunlight. However, conflicts between space limitations and development needs still arise during implementation of these regulations. This study uses simulation analysis to examine the effectiveness and possible problems of the provisions related to sunlight rights in building technical regulations. The research concludes with two key findings: Firstly, the simulation analysis shows that, provided the building coverage ratio and design are properly planned, it is not difficult for a 60-metre-high building to meet the legal requirements for basic sunlight rights. Secondly, at the regulatory level, although Article 39-1 of the current 'Building Technical Regulations' clearly states the requirements for sunshine hours, the definition of 'effective sunshine for more than one hour' remains unclear. For example, disputes may arise over whether the average or minimum sunshine should be used. Therefore, this study recommends clarifying the meaning of the text to improve the clarity and consistency of regulatory enforcement.*

***Keywords*—** *Right to sunlight, building technical regulations, simulation.*

I. Introduction

The right to sunlight is an important issue in urban development and building design, especially in highly urbanized areas. The right to sunlight involves the impact of a building on its surrounding environment, including its impact on nearby buildings, public spaces and residents' lives. In order to safeguard the public interest, many cities have enacted building technical rules, which include regulations to protect the right to sunlight. However, the formulation and implementation of these standards may face many challenges. On the one hand, urban space is limited, and the expansion of buildings and the construction of high-rise buildings may lead to a decrease in sunlight in nearby areas, which in turn affects the quality of life of residents. On the other hand, building development is also part of urban economic and social development, so it is necessary to balance the relationship between protecting the right to sunlight and promoting building development.

The purpose of this study is to conduct a normative simulation analysis of the protection of sunlight rights in building technical rules in order to gain a deeper understanding of the actual effects and potential problems of these rules. Specifically, the research objectives include:

1. Evaluate the regulations and standards related to the right to sunlight in the current building technical rules: Analyze the specific regulations and standards related to the right to sunlight in the current urban building technical rules, and understand their content and formulation background.
2. Simulate the sunlight impact under different building development scenarios: Use simulation tools to simulate and analyze the sunlight conditions under different building development scenarios, including the increase of high-rise buildings, building expansion, etc.
3. Evaluate the actual effect of current rules: Compare simulation results with actual on-site sunlight conditions, evaluate the actual effect of current building technical rules in protecting sunlight rights, and identify possible defects or improvement points.
4. Make suggestions and improvement measures: Based on the analysis results, put forward improvement suggestions for the current building technical rules to balance the contradiction between building development and the protection of sunlight rights and promote urban sustainable development.

Through these research objectives, we can have a more comprehensive understanding of the protection standards for sunlight rights in building technical rules, and provide more scientific and reasonable guidance for urban planning and architectural design, ensuring that urban development achieves the goal of sustainable development while protecting the rights and interests of residents.

II. Research Methods

The analysis methods and steps to be adopted in this study are as follows:

1. Literature review: Relevant laws and regulations, building technical rules and previous studies were reviewed to understand the theoretical basis and practical experience related to the protection of sunlight rights.
2. Analysis of building technical rules: Analyze the relevant provisions on sunlight rights in the current building technical rules to understand their specific content and specifications.
3. Simulation tool selection: Select appropriate simulation tools or sunlight simulation software to simulate the sunlight impact under different building development scenarios.
4. Simulation scenario setting: Based on the geographic information of the actual city or specific area, different building

Spring C. Hsu, "A simulation analysis of the right to sunlight in accordance with Taiwan's building technical regulations," *International Research Journal of Advanced Engineering and Science*, Volume 10, Issue 4, pp. 56-59, 2025.

International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

development scenarios are set, including the increase of high-rise buildings, building expansion, etc.

5. Sunlight simulation analysis: Use simulation tools to simulate the sunlight of the set scene and obtain sunlight data for different time periods and locations, as shown in Figures 1 and 2.

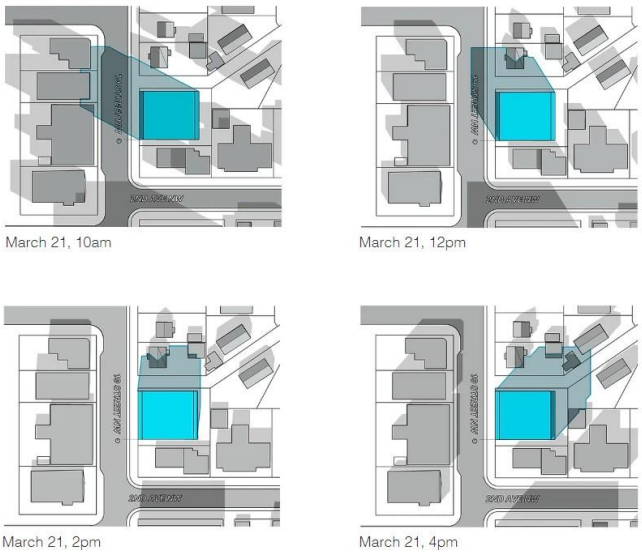

Fig. 1. Sunlight shadow simulation diagram for new buildings at a general height.
Source: Innurskape Projects

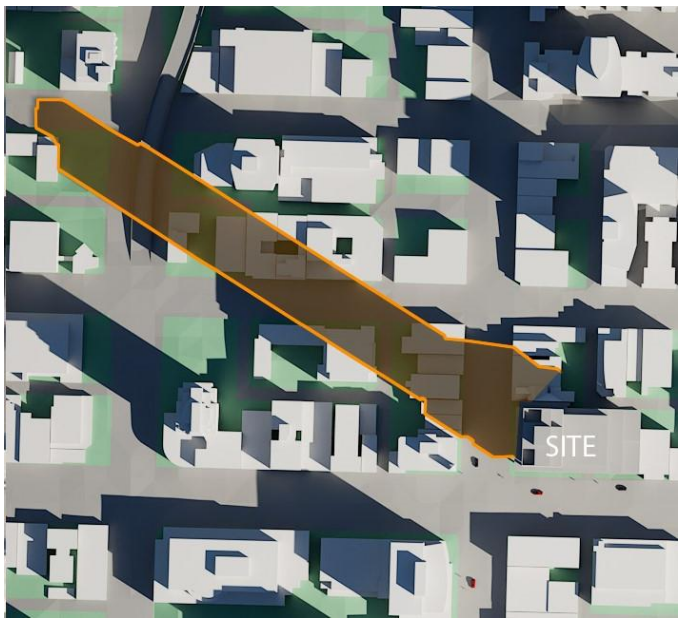

Fig. 2. Sunlight shadow simulation diagram of a new high-rise building.
Source: City Hall Watch

6. Effect evaluation: Evaluate the sunlight protection effect under different building development scenarios, including the impact on the surrounding environment and residents' lives.

7. Problem identification and improvement suggestions: Based on simulation results and field investigations, identify possible problems in current building technology rules and put forward improvement suggestions and policy recommendations.

8. Reporting and Communication: Write research reports that clearly present research methods, simulation results, problem identification and recommendations, and communicate effectively with relevant stakeholders.

These research methods will help to comprehensively evaluate the protection standards of sunlight rights in building technical rules and provide a scientific basis to improve the current rules and promote the balance between urban building development and residents' rights and interests.

III. Sunlight Shadow Simulation and Analysis

According to Article 39-1 of the Building Technical regulations for Building Design and Construction, the shadows cast by newly built or extended buildings exceeding 21 meters in height on the winter solstice should ensure that the adjacent residential or commercial areas have at least one hour of effective sunlight. This study uses the ShadeMap sunlight simulation tool (as shown in Figures 3 and 4) to analyze the impact of a proposed building (as shown in Figures 5 and 6) on the surrounding sunlight rights at a site in Zhongshan District, Taipei City.

Fig. 3. Analysis of sunlight and shadow at different times of day.

Fig. 4. Analysis of daily sunlight hours.

According to regulations, the simulation date is set as December 21, 2024, the winter solstice, and then an analysis of the daily sunshine hours of surrounding existing buildings is conducted, as shown in Figure 7-13. Simulation analysis found that after the construction of this simulated building, the surrounding buildings would receive a minimum of 6.5 hours of sunshine on the winter solstice and a maximum of 10.2 hours.

Spring C. Hsu, "A simulation analysis of the right to sunlight in accordance with Taiwan's building technical regulations," *International Research Journal of Advanced Engineering and Science*, Volume 10, Issue 4, pp. 56-59, 2025.

International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

Therefore, the simulated construction project complies with the legal requirements for sunlight rights.

Fig. 5. Site location for simulation planning.

Fig. 6. A 60-meter building for simulation planning.

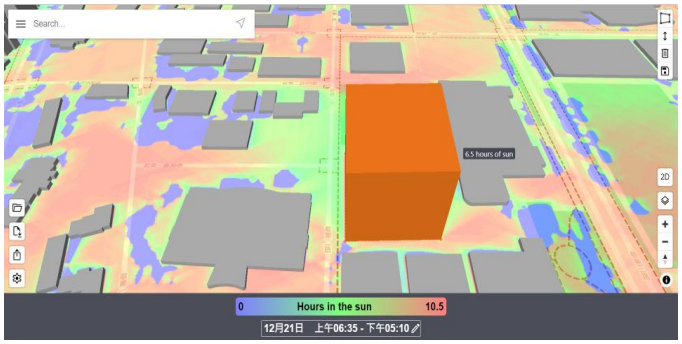

Fig. 7. The minimum number of hours of sunlight for buildings on the east side.

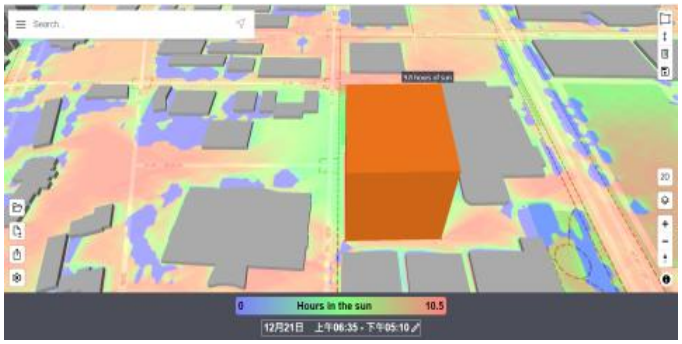

Fig. 8. The minimum number of hours of sunlight for buildings on the north side.

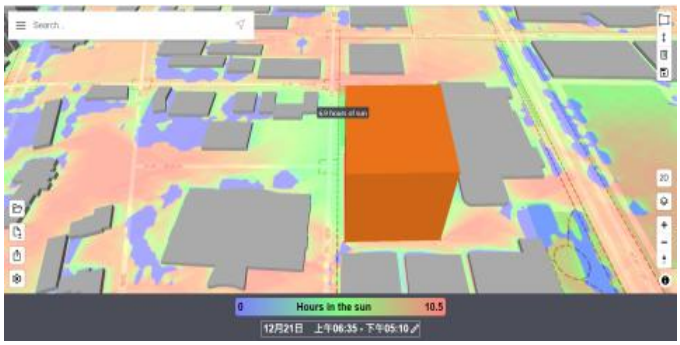

Fig. 9. Minimum number of hours of sunlight for buildings on the north-west side.

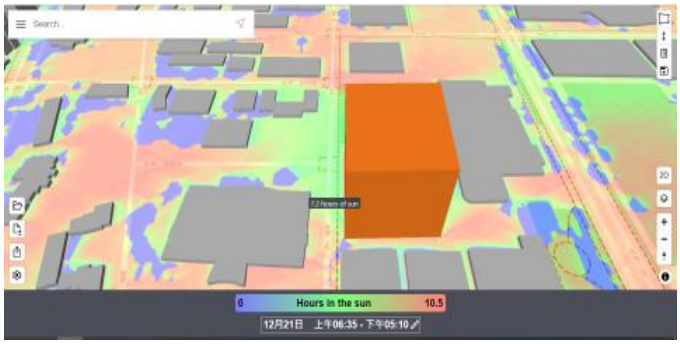

Fig. 10. The minimum number of hours of sunlight for buildings on the west side.

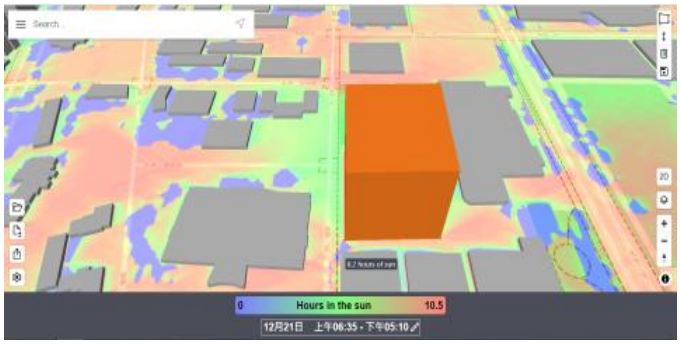

Fig. 11. The minimum number of hours of sunlight for buildings on the south-west side.

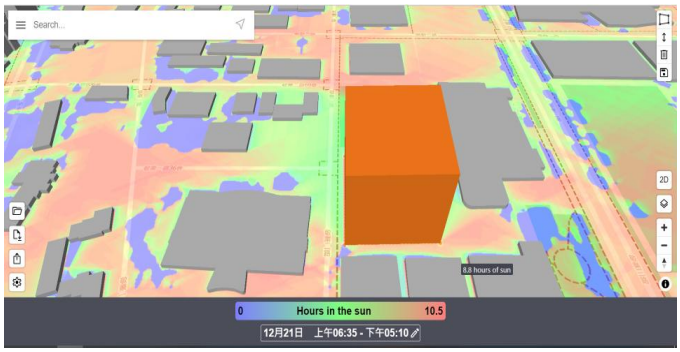

Fig. 12. The minimum number of hours of sunlight for buildings on the south side.

Spring C. Hsu, “A simulation analysis of the right to sunlight in accordance with Taiwan's building technical regulations,” *International Research Journal of Advanced Engineering and Science*, Volume 10, Issue 4, pp. 56-59, 2025.

International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

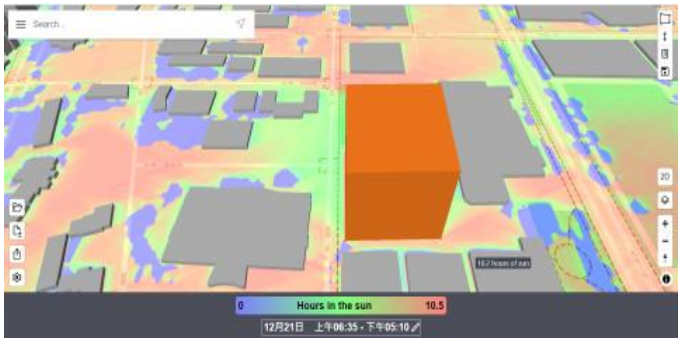

Fig. 13. The minimum number of hours of sunlight for buildings on the south-east side.

IV. Conclusion and Recommendations

The results of the sunlight simulation analysis of the building modelled in this study show that, even for a 60-meter-high building, complying with the basic requirements of the sunlight rights law is not too difficult, provided the building coverage ratio and design are properly adjusted.

However, according to Article 39-1 of the current Building Technical Regulations for Building Design and Construction, shadows cast by newly built or extended buildings exceeding 21 meters in height on the winter solstice must ensure that adjacent residential or commercial areas receive more than one hour of effective sunlight. However, the meaning of this text is unclear. For example, what is meant by 'effective sunshine' for more than one hour? Should this be the average or the minimum? The text should be clarified to avoid disputes over interpretation.

References

[1] W. Kim, Y. Jeon, and Y. kim, "Simulation-based optimization of an integrated daylighting and HVAC system using the design of experiments method." Applied Energy, vol. 162, no. 15, pp. 666-674, 2016.
[2] Q. Zeng. And G. Ou, "Daylighting Performance Simulation and Optimization Design of a "Campus Living Room" Based on BIM Technology - A Case Study in a Region with Hot Summers and Cold Winters." Buildings, vol. 15, no. 2904, pp. 1-21, 2025.
[3] S. Vaisi, H.M. Gorji, and N. Shafei, "Application of Simulation-Based Metrics to Improve the Daylight Performance of a Secondary School, An Approach for Green Building Designers and Architects." Advances in Environmental and Engineering Research, vol. 5, no.2, https://www.lidsen.com/journals/aeer/aeer-05-02-012, 2024.
[4] J. Hu, and S. Olbina, "Simulation-Based Model for Integrated Daylighting System Design." Journal of Computing in Civil Engineering, vol. 28, no. 5, https://doi.org/10.1061/(ASCE)CP.1943-5487.0000336, 2014.
[5] J. Rucinska, and A. Trzaski, "Measurements and Simulation Study of Daylight Availability and Its Impact on the Heating, Cooling and Lighting Energy Demand in an Educational Building." Energies, vol. 13, no. 10, https://doi.org/10.3390/en13102555, 2020.
[6] G. Kousalyadevi, and G. Lavanya, "Optimal investigation of daylighting and energy efficiency in industrial building using energy-efficient velux daylighting simulation." Journal of Asian Architecture and Building Engineering, vol. 18, no. 4, pp. 271-284, 2019.
[7] Innurskape Projects, https://www.innurskape.ca/sun-and-shadow-study.
[8] City Hall Watch, https://cityhallwatch.wordpress.com/2022/04/17/are-shadow-studies-of-1477-w-broadway-accurate/

Spring C. Hsu, "A simulation analysis of the right to sunlight in accordance with Taiwan's building technical regulations," *International Research Journal of Advanced Engineering and Science*, Volume 10, Issue 4, pp. 56-59, 2025.