The Analysis of the Sheltering and Shading of the Movable House in Winter: A Case Study of Sichuan Disaster Area

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Abstract

The analysis model is set up in the Ecotect Analysis, and set up the parameters to simulate the shelter of the adjacent movable houses. Compared south wall windows of the movable room in winter under different spacing. The results show that when the ratio of the Space between movable house to the height of the movable house is most suitable for [1.0,1.2] the shelter condition is most suitable.

Keywords

Movable house; shading; coefficient.

1. Introduction

Take Qingchuan County in 2018 Wenchuan earthquake as an example, 99% of houses and more than 140 thousand mu of arable land were damaged, the river was seriously congested, and dammed lakes flooded the valley. The safe land for resettlement is less, which makes the spacing of the movable houses in the resettlement area compressed, resulting in unobstructed ventilation, summer thermal comfort drops and the severe shading in winter. Under the premise of efficient use of land, reducing the shelter of the movable panel room, improving the thermal comfort of the movable board house in winter, and reducing the shelter between the movable panel houses will help to improve the comfort of the outdoor activity space and increase the interaction of the neighborhood. Helps the psychological recovery after the disaster.

2. Analysis object

For the convenience of simulation, three double-sided lighting boardroom unit can be seen as a group which is selected as a simulation object. The unit size is 3700mm * 5600mm * 3700mm. In the south wall, the door is 1850mm * 2000mm, the window is 1850mm * 800mm. And the window in the north wall is 1850mm*800mm. In the south wall and north wall, the windows are opposite. There is a retaining wall in the south of the panel house group, which simulates the shelter from the neighboring movable houses units. The retaining wall size is 11100mm*3700mm, and the geometric model is shown in Figure 1.

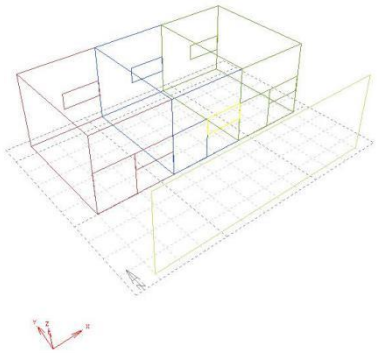

Figure 1. The geometric model is shown

3. Parameter settings

Calculate the windows in the middle movable house(the sheltering of middle movable house is more serious than the end of the active board), and the weather parameters of the Chengdu area are introduced to calculate the sheltering of the winter solstice. This simulation selected seven cases:D/H=0.6, 0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.3, 1.4, 1.5. “D” is the distance between the movable houses unit and the retaining wall, which simulates the distance between movable houses in the actual situation. “H” is the height of the movable house. This simulation takes the movable house height H=3700mm which is common in the WenChuan earthquake. The orientation of the board room is just south.

4. Results analysis

Shading coefficient(SC.) is generally used to describe the shading potential of certain objects, typically glazing and shading devices, or a combination of both. Thus, a shading coefficient of 100% means there is very little shading potential, while a low shading coefficient indicates a high shading potential.

Table 1.October-February Avg. SC.

Mouth D/H	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
October	71.5%	92.1%	99.1%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
November	7.7%	27.4%	55.7%	76.5%	89.5%	95.0%	97.6%	100.0%	100.0%	100.0%
December	2.5%	16.2%	36.2%	59.6%	75.7%	86.4%	93.5%	96.4%	98.6%	100.0%
January	19.0%	44.9%	71.2%	85.8%	93.2%	96.8%	99.3%	100.0%	100.0%	100.0%
February	91.8%	98.8%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Simulate the Average Shading coefficient October-February in ten cases(Table 1). It can be seen that when D/H = 0.6, compared with the other nine cases, the Avg.SC in each month is the smallest. When D/H = 1.5, the Avg.SC in each month is 100%. That is, when D/H=1.5, each day of October to February, the movable houses has no shelter to the south-facing windows of its adjacent movable houses.When D/H = 0.8, the Avg.SC in February first reaches 100%. When D/H = 0.9, the Avg.SC in October reaches 100%. When D/H = 1.5, the Avg SC.in December reaches 100%. When D/H = 1.3, except for December, Avg.SC for all other months reached 100%, and when D/H increased from 1.3 to 1.5, December's Avg.SC increased from 96.4% to 100%. In line with the principle of improving land utilization, D/H is not necessarily greater than 1.5, and should not be greater than 1.3. When D/H is within the interval [0.6, 0.7], the Avg.SC values in November, December, and January do not exceed 50%, indicating that more than half of the time is covered and should be avoided as far as possible.

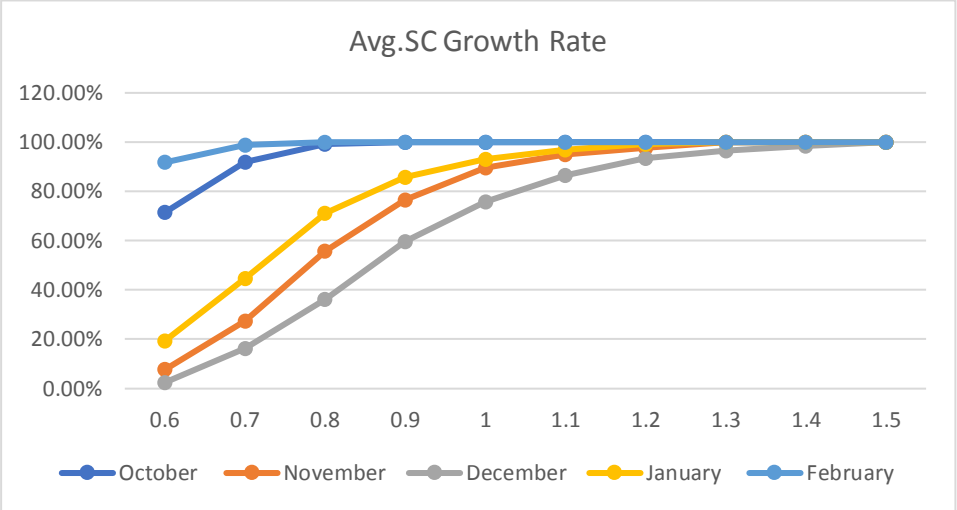

Figure 2. within the interval

From the Figure 2,when the D/H is within the interval [0.7,0.9], the Avg.SC growth is obvious, indicating that the movable houses have a more obvious improvement on occlusion of south window of the adjacent movable houses. When the D/H is within the interval [1.0,1.2], the Avg.SC growth is slow, indicating that the movable houses have a slight improvement in the occlusion of the south window of the movable houses. When D/H is in the interval [1.2,1.4], the growth of Avg.SC is not significant.

According to the hourly shading data of winter solstice, with the increase of D/H , the occlusion rate decreases in each period, and the most obvious change in the [11:00,13:00]. When the D/H value is greater than 0.9, the section basically has no occlusion. As the outdoor space, the shelter of movable house in winter also affects the neighborhood and outdoor activities. The outdoor space in the post disaster area is sometimes used as the housework space, so reducing the shelter helps to promote the neighborhood and outdoor activities and improve the comfort. The time of neighborhood, outdoor activities and doorway housework is usually [9:00,11:00] and [15:00,17:00], so the sheltering rate should be reduced in this period of time.From the Figure 3, when D/H is within the interval [0.6, 1.0], the occlusion rate in the above period is high. We use south-facing windows as the object of calculation, at this time, the outdoor space between movable houses will be more obstructed and it should be avoided.

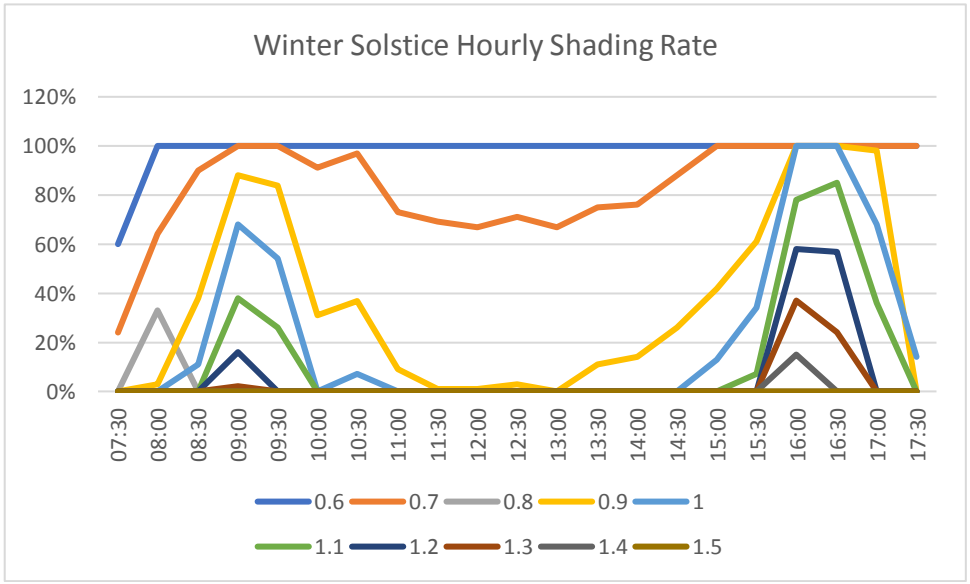

Figure 3. Should be avoided

5. Conclusion

In summary, under the premise of efficient land use and considering the influence of shelter on the outdoor space, when the entrance of the movable houses faces south, the ratio of the distance between the movable houses to movable house height should be [1.0, 1, 2]. At this time, the SC.(shading coefficient) is larger throughout the year, and the shading is smaller, and the important period of the winter solstice meets a smaller shading rate.

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