

# Design Suggestions and Economic Analysis of Light Frame Shear Wall

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**Abstract.** Based on the results of the nonlinear parametric analysis interview, some design suggestions of light frame shear wall are put forward from studs spacing, height-width ratio of wall, the size and position of the openings. In addition, a real example is studied and analyzed on the design and optimization of light frame shear wall, with an economic analysis. The research shows that design suggestions and construction measurement can increase material utilization, economize on energy and material, improve produces condition and reduce construction period.

## Introduction

The light wood structure is to use the uniform with wooden houses to withstand various plane and space effect of the stress system. With the application of light wood frame house in our country in recent years more and more widely, it is necessary for light wood structure system to carry out systematic theoretical and experimental research, in order to promote the development of the light timber structure system in our country. The main research contents of the study are mainly concentrated on the static or dynamic loading tests of shear walls. The main experimental parameters are test loading mode, panel size and material, connecting parts, Shear wall hole, etc., domestic scholars on the light timber structure of the overall seismic performance and shear wall of the lateral stiffness of the content to do a certain degree of research. For example, Shenton[1] test through the shear wall of wood structure that the static loading method is significantly greater than the wall loading method of dynamic loading. Cheung and Itani [2]considered the non-linear slip of the connected nail from the load-slip characteristics in the finite element analysis. Dolan[3] established a wooden shear wall analysis model, in the model using spring units to consider the panel and the panel and the sliding between the wooden frame. Doudak, G[4] through the experiment and the finite element software respectively to the light timber structure shear wall opening is different and the whole does not open the mechanical performance has carried on the test and the analysis. Nan-nan zhou and Min-juan He [5] [6] applied a unidirectional load to a certain shear wall to simulate and analyze the mechanical behavior and structural change of the shear wall. Based on the conclusion of the nonlinear finite element analysis of the light-weight timber structure shear wall model, the design proposal and construction requirements of the light timber-framed shear wall are proposed. On this basis, the practical engineering case is taken as the economic object Analysis, the results that, in accordance with the proposed design recommendations proposed in this paper, can be effective materials, with better economy.

## Finite Element Analysis and Conclusions

The main parameters were wall-to-column spacing, wall height-to-width ratio, wall opening, hole location, and axial compression. The main factors affecting the mechanical properties of wood-wall, shear wall were obtained by parametric analysis on a large number of results. The influence law of the shear wall in the process of the stress control is determined. The results show that when the wall column spacing is the same, the lateral stiffness of the wall column decreases with the increase of the height-to-width ratio of the wall, and the change trend of the wall column remains almost constant when the height-to-width ratio is greater than 2; When the height-to-width ratio of the wall is the same, with the increase of the spacing of the pillars, the lateral stiffness decreases and the trend of the wall height-to-width ratio is basically the same. When the wall-column spacing is





The wall spacing of 600mm column spacing applicable, this time a total of 13 wall columns, than the original design to save six wall columns.

Table 1 Comparison of wall material design for wall column design

Wood shear wall number	Wall columns spacing (mm)	Wood shear wall area (m2)	Wall columns volume (m3)	Amount of wall columns per unit area (m3)	Unit area rate of materials
Building 13th F-F shaft wall	400	50.49	0.63	0.012	33.33%
	600	50.49	0.42	0.008	

Table 1 to meet the strength requirements of the case, and the design of the reception center wall column spacing compared to the larger rate of material, so that its economy is better. On the 08 units of the BB axis wall and 13 households in the FF axis wall, compared to the original design and the proposed design of the economic comparative analysis, the results shown below (the market price of 3600 Chinese fir wall studs Yuan / m3):

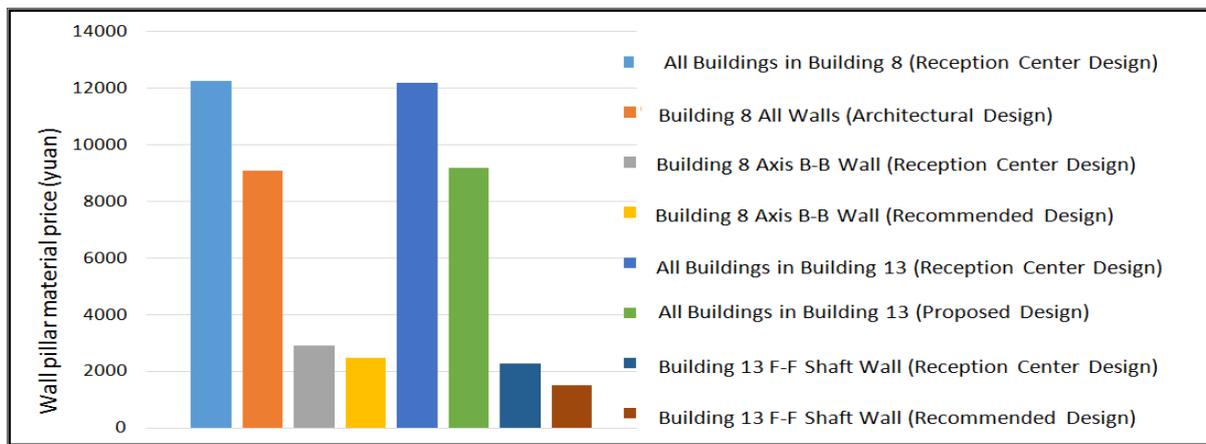


Fig.3. wall pillar material price economic comparison chart

From the above chart we can see that the design can not only save materials, but also can save the cost. The wall-column material prices calculated by the proposed design values in Fig.3 are significantly lower than those at the reception center, and the proposed material price is lower than the price of the material designed by the reception center A quarter or so.

## Conclusion

Through the result of structural design and economic comparison, the design proposal and construction requirement proposed in this paper can effectively save materials and meet the requirements of bearing capacity, and have good engineering economy.

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