

Ancient Buildings Vibration Control Technology Research Status and Future Prospects

Liming Zhu, Baofeng Miao *, Shiling Xing

Nanjing Tech University, China

* 956590697@qq.com

Abstract. Ancient buildings as the ancestors left us precious cultural heritage, we work as a future generation handle protection of ancient buildings. Many times, in recent years due to natural disaster make damage to buildings and caused by the rapid development of urban traffic vibration also has influence on the ancient building. This paper will respectively from natural vibration and the two aspects of urban development brought about by the vibration, analyzes its present form in order to prospect for its future, put forward the corresponding development strategy.

Keywords: ancient buildings; Vibration control technology; the status quo. Future.

1. Ancient Architectural Structures Seismic Technology

Earthquakes in our country is a relatively common natural disaster, has recorded in history occurred in 18 earthquakes over magnitude 7 in our country, in recent years, it has been the Wenchuan earthquake, the Sichuan province is one of the important centre of historical and cultural heritage in our country, this makes a lot of feeling of ancient buildings in wenchuan earthquake damage. Below will respectively from wood and stone structure of ancient building shock technology is discussed.

1.1 Wood Ancient Shock Technology

Wood structure of ancient buildings due to its main has built wooden by, and for wood had a very good relay and resistance to shear, this makes the ancient buildings after the earthquake of timberwork when can, with a good aseismic capacity. And wooden buildings often have GongDou the shape of the roof, in the event of a technology is larger earthquake GongDou to energy consumption, thus reduce the influence caused by vibration [1].

Wood structure of the ancient buildings in the earthquake is the easiest to assemble county problems including it appear at the top of tiles fell, support beam displacement, house whole framework collapsed and even cause the condition of the damaged foundation, and the cause of these conditions often because timberwork buildings more omissions in daily maintenance, ensure the quality of the lack of restoration project.

Wooden buildings in the maintenance of proper cases has a relatively good shockproof performance, through the simulation practice concluded that found that when wooden buildings in the maintenance of relatively perfect circumstances, it is able to withstand below 9.0 -magnitude earthquake shock ability, so in ascension timberwork buildings aseismic capacity of the most important thing is to carry on the corresponding repair. The more common way of repairing is through the use of carbon fiber cloth reinforced with metal parts of the combining site, through flat steel reinforcement of anchor nodes on the beam reinforced with bearing column, in order to reduce the possibility of transverse. In order to clearly show the specific principle of shockproof, tower below will show so seismic principle.

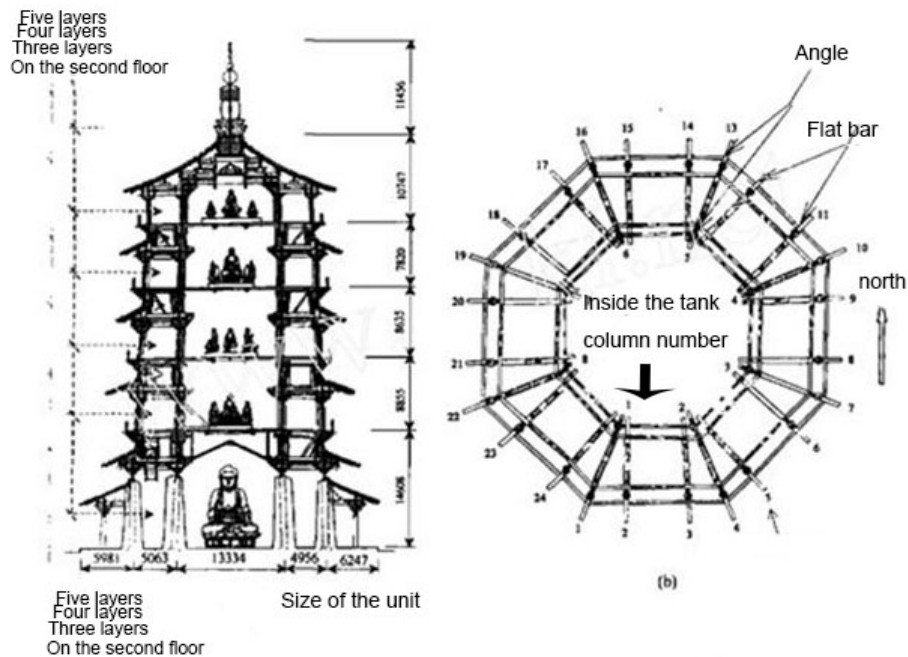


Figure 1. The principle diagram of the tower during the earthquake

1.2 Ancient Stone Structure Shock Technology

Stone structure of buildings without mainly exist in the form of stone, stone, stone floor, when the region of an earthquake, ancient stone structure is likely to be due to earthquake damage in local, even when the earthquake in severe cases, the overall collapse would happen. Ancient stone structure when has the more columns, its seismic performance is better. In the seismic damage of rock structure of ancient building survey statistics found that after the ancient stone structure often are made by the top started to collapse, in such case the reason is because the ancient stone structure has the very strong resistance to pressure in building materials, but due to its low shear will cause its collapse status often appear from the top [2].

Ancient stone structure can be divided into two kinds, which has two kinds of brick and masonry classification respectively. Brick structure of ancient buildings in the brick to join a timber and other materials so as to achieve the purpose of reinforcement is obtained. On masonry structure buildings shock technology in the present study found that, due to masonry structure of ancient buildings are often caused by the reason of its material form its easily due to the vibration of the earthquake in the collapsed at the top of the situation, therefore the present related research has been made in order to improve the shock resistance. Main methods include in package, its outer join steel using reinforced by cement made from mixed pulp surface, such as ways to improve the stone brick structure earthquake resistance of buildings.

2. Ancient Architectural Structures Vibration Control Technology

With the continuous development of our economy, our country the size of the cities are also growing, traffic lines with the scale enlargement of urban nature constantly extends outward. This makes a lot of traffic lines will approach some buildings nearby, the transportation route in the process of operation will bring some vibration for the environment, study abroad has ever found due to transportation vibration = made by ancient buildings damaged condition. In order to avoid such a situation on the more ancient buildings, it is necessary to carry out the corresponding research.

2.1 Vibration Control Technology of Ancient Theories

Ancient building vibration control technology is mainly focused on the following aspects, first, the study of vibration source, only to find the source of vibration, from its origin to its. In the second. In the propagation law of medium is studied, based on the analysis comparison to find out the rule to the long-term or short-term tolerance test, determine its resistance to vibration standard. Finally, is to study its vibration strengthening study of the relevant technical measures to achieve the purpose of the antivibration [3].

In the process of research, first of all to build the mechanics model of ancient buildings. When due to all kinds of transportation vibration, both wood and stone structure of ancient architecture can produce resonance with the vibration effect, when the entire building structure is in the same vibration mode, can produce the complete modal space. Such space mode may be shear vibration curve. When will this model into the ancient stone timberwork, shear cantilever bar model to calculate its use, and masonry class to the ancient buildings are using table interface curved suspension model to calculate.

Secondly, we must make clear the calculation method of vibration, in order to mobilize the vibrations of vibration for the corresponding calculation, the calculation methods of using finite element method. Through this method can achieve the vibration of an effect on the transportation analysis, the purpose of better through this form established calculation model. At the same time complementary with coupling dynamics, in order to calculate the vehicle dynamic response in ancient buildings.

2.2 Ancient Antivibration Measures

In today's increasing traffic routes, in order to ensure that the ancient buildings from the condition of the damaged and the influence of vibration, is going to take some corresponding measures to its, first set up in the middle of the tunnel steel spring floating slab can achieve the purpose of reduce resonance, when vehicles through the tunnel, steel spring floating slab and energy saving to realize the purpose of the noise reduction, after its actual effect is found when setting steel spring floating slab, it is no longer need to pass the speed limit in an effort to reduce the vibration on buildings. In order to clearly show the vibration principle, the article will be in the form of images to display, the details as shown in figure 2.

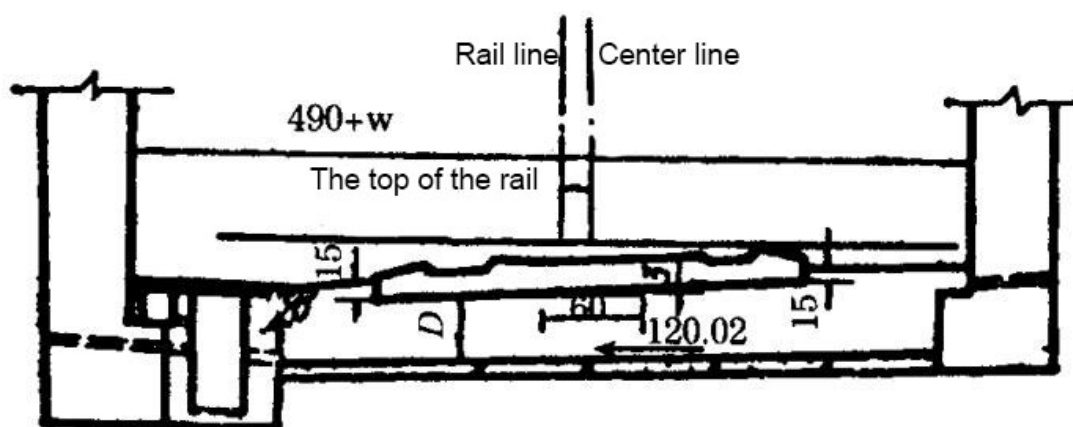


Figure 2. steel spring floating slab schematic diagram

In addition to vibration isolation system, the vibration isolation system is composed of bracket, damper etc., isolation methods including relative isolation, swaying friction vibration isolation and vibration isolation, etc. And through the study on the way for the construction of the most advanced vibration isolation, but in the more advanced methods are rarely applied to actual, so ancient ant vibration also needs to use more advanced science and technology in the future.

3. Ancient Architectural Structures Vibration Control Technology

Through the discussion of the above found in ancient building vibration control technology, to really achieve the moment there is work to continue. This article will put forward to its prospect, the first to build its stable ancient buildings without risk assessment system, establish a complete risk graph, in the form of a hierarchical to distinguish the various ancient earthquake risk, to establish the key protection targets.

Second, we should accordingly to the disaster regulation research, find out the suitable for the law of ancient buildings, decrease as far as possible to paraphrase of modern vibration reduction technology. Finally, in the reinforcement work of the ancient buildings, first, to analyze its theoretical knowledge, make finite element analysis, secondly in terms of the choice of materials to be more fastidious, respectively from the performance, connectivity into [4] considering the actual situation.

Finally, in terms of use, after years of continuous efforts, it has produced results, but still need to vigorously promote to make buildings vibration reduction technology is more suitable for actual work.

4. Conclusion

Through the discussion of this paper, on the current situation of the ancient architecture of the control technology are analyzed, and its application and actual situation of the present is summarized, the prospect for its future, I hope this article for the future development of ancient buildings vibration control technology to make a certain contribution.

References

- [1]. wei-ning liu, Zheng Sheng blue, xiao-jing sun. Ancient buildings vibration standard classification study [J]. Journal of protection of cultural relics and archaeological science, 2013, 25 (01): 54-60.
- [2]. mamun, wei-ning liu guo-hua deng, Qian Chunyu, Yuan Yang. Based on the calibration method of the vibration impact on the xi 'an bell tower research [J]. Journal of engineering mechanics, 2013, 30 (12): 206-212.
- [3]. Chen Ruichun. Research on the effects of xi 'an subway train vibration on the clock tower [D]. Beijing Jiaotong University, 2008.
- [4]. gongzuoyi. Urban traffic track vibration on the influence of masonry pagodas.