Research Article

On the Influence of Pile Foundation Settlement of Existing High-Rise Buildings on the Surrounding Buildings

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Pile foundation settlement is a kind of foundation form. In recent years, because of the increasing population and economic development in China, high-rise buildings have emerged in people’s vision. Due to the development of engineering construction, the type and technology of pile foundation, as well as the control and detection of the single pile and pile group have been greatly improved. In view of the influence of pile foundation settlement on the surrounding environment of high-rise buildings, this paper mainly studies from the angle of single pile settlement and pile group settlement. According to the construction method of pile foundation, the static pressure sinking pipe cast-in-place pile can produce soil squeezing effect in pile foundation construction. The experimental analysis was carried out. According to the engineering example, finite element numerical simulation is used to analyze the influence degree of pile foundation settlement on adjacent buildings with and without raft, and the feasibility and correctness of numerical simulation are analyzed by comparing the simulation results with the measured values. This paper mainly studies the influence of pile foundation settlement of high-rise buildings on surrounding buildings from the aspects of problems and solutions.

1. Introduction

Since the reform and opening up, along with the continuous development of China’s economic situation, the scale of urbanization life has been constantly emerging. However, due to the limited area of China’s land resources, it also leads to the shortage of urban buildings, which requires improving of the utilization rate of urban land. People began to diversify limited land for urban construction, resulting in the emergence of high-rise buildings, 3-D transportation lines, 3-D laying of urban pipelines, and other facilities. Building high-rise and multistorey buildings to improve land use efficiency requires a foundation with good stability and strong bearing capacity. Because natural soil cannot meet the requirements of this construction, pile foundation has the advantages of good stability, strong bearing capacity, and strong pull-out resistance, which has been widely used in high-rise building foundation. However, in complex situations such as underground tunnels in high-rise buildings, it will have bad effects on pile foundation construction or surrounding buildings. And, the existing reference materials about the influence of pile foundation construction and settlement on adjacent buildings are relatively few, but in practical engineering, the influence of pile foundation construction and settlement on adjacent buildings has been paid more and more attention. Therefore, the influence of pile foundation settlement on adjacent buildings studied in this paper will provide a great help for the future construction of pile foundation. In this paper, the finite element method and numerical simulation method are used to study the influence of pile foundation settlement on the surrounding environment of existing high-rise buildings. Therefore, the study of pile foundation settlement of high-rise buildings is imminent and has very important theoretical significance and practical value. The displacement field of surrounding soil is obtained by using the settlement theory of pile foundation based on the shear displacement method, and then, the settlement value and displacement of surrounding buildings are calculated, which are verified by numerical simulation and engineering examples.
Nowadays, the society is constantly changing to the direction of urbanization and modernization. The emergence of high-rise buildings is also a social demand. The rising height reflects not only the increasing cost of land and the demand for space utilization but also the flaunting of capital strength and the symbol of economic prosperity. The existence of high-rise buildings will have an impact on low-rise buildings and many surrounding environments. The impact of new high-rise buildings on the surrounding environment is mainly manifested in the excavation stage of the building foundation pit and the construction stage of building foundation. There are few studies on the loading stage of the main structure of the new building and the use stage of the building after the roof is sealed, and most of the limited studies do not consider the influence of the superstructure. The method only regards the load of the superstructure as the uniformly distributed load on the basis of the building. This method cannot fully reflect the additional impact of the building loading on the surrounding environment. For the use stage of the building after roof sealing, when the building is subjected to wind load, additional deformation will occur to the surrounding environment under the action of wind load. At present, there is no clear conclusion about the additional deformation of the surrounding environment caused by wind load in China. Pile foundation is composed of piles and caps connected to the top of piles. It is widely used in the construction of high-rise buildings. It is of great significance to ensure the safety and stability of high-rise buildings. In the event of natural disasters such as earthquakes or typhoons, pile foundations can resist horizontal and moment loads caused by earthquakes or typhoons by virtue of their lateral stiffness and overall anti-overturning ability, so as to avoid overturning of high-rise buildings and ensure the stability of high-rise buildings. The development of the high-rise building green architectural design concept is a new concept in recent years. Green energy-saving technology is the main technical basis of the green architectural design. When applied to the high-rise building design, it mainly refers to the need to combine the characteristics of the high-rise building itself to the greatest extent, with the help of the surrounding natural conditions and environment. Green building design is an architectural design method based on environmental protection skills, using advanced science and technology and equipment. The main characteristics of the intelligent building include comfort, efficiency, adaptability, safety, convenience, and reliability. The application of modern technology can comprehensively enhance people's psychological and physiological experience and create comfortable conditions for people from lighting, greening, lighting, ventilation, and other aspects. At the same time, the application of the intelligent system greatly saves the consumption and expenditure of resources, energy, and expenses, breaks the limitation of time and space, improves the efficiency of the use of resources, and brings more efficient management and services to people. In the process of architectural design, we should pay attention to the humanization of the architectural space and consider many factors, including artistic factors, technical factors, and scientific factors. If the staff can work in a comfortable building environment, people will not only have a sense of satisfaction but also can effectively improve work innovation and efficiency. The value of architecture depends to a great extent on the comfort of the architectural environment, which involves many aspects, such as environmental psychology, architectural acoustics, and architectural optics. In the design of architectural schemes, special groups of people should be considered, including the disabled, elderly, women, and children, in order to create a reasonable and scientific barrier-free environment, which fully reflects the humanization. In the study of soil compaction effect of pile foundation, it applied the theory of circular hole expansion proposed by predecessors to analyze the elastic-plastic behavior of pipe piles and obtained the analytical expressions of the radius of the plastic zone and displacement of the soil body. It analyzed the displacement field produced by the static pressure pile by the finite element method and gave the influence of the modulus ratio of the pile to soil and friction characteristics of the pile-soil interface on the displacement field of pile driving. Dong [1], based on the theory of average volumetric plastic strain of sand, proposed a simplified method for predicting the size of the plastic zone around static pressure piles is proposed, and the influence of pile parameters on the plastic zone is analyzed. There are many achievements about the influence of foundation pit excavation on the surrounding environment. Wang and Xu [2], based on a large number of engineering data in Shanghai, proposed the predictor of the surface settlement curve and also gave the method of predicting the additional deformation of buildings caused by foundation pit excavation. It analyzed that the deformation of adjacent buildings of foundation pits corresponding to different deformation forms of retaining structures. The results showed that when kicking and convex deformation occurred on the surface of the retaining structures, the buildings adjacent to the foundation pits would undergo notable concave deflection. It applied physical model tests and numerical simulation methods to analyze the influence of soil displacement on the deformation, cracks, and wall stiffness of existing masonry buildings. Tan Yong and others measured the influence of a deep foundation pit on the settlement of nearby buildings. The analysis results show that the distance between the building and the foundation pit, the type of the building structure, and the type of building foundation will significantly affect the final settlement value.

The settlement theory of pile foundation includes single pile settlement theory and pile group settlement theory. The settlement theory of single pile is very important to analyze the influence of pile foundation construction and settlement on adjacent buildings. According to the settlement of the single pile, it can be extended to the calculation of pile group settlement. At present, the calculation methods of single pile settlement mainly include load transfer method, elastic theory method, shear displacement method, and numerical analysis method and its simplified method. The shear displacement method was initially established by Cooke [3] on the basis of experimental and theoretical analysis. The shear displacement method assumes that the surrounding body of
the pile mainly bears shear deformation, and there is no relative displacement between the pile and the soil. The frictional resistance of the pile side transfers to the surrounding area through the annular element. The deformation of the surrounding soil around the pile side is ideally simplified as a concentric cylinder. According to the shear displacement method, Ma et al. [4, 5] generalized it from the elastic stage to plastic stage and obtained the analysis of the nonlinear displacement field of the soil around the pile. With the rapid development of numerical analysis technology and computer technology and its wide application in engineering practice, the numerical simulation method has also been rapidly developed and improved, and the finite element method has been widely used in pile foundation analysis. In the analysis of piles, it is precisely because of the maturity and powerful function of the finite element method, which can well consider the nonlinearity and nonuniformity of soil and the characteristics of the pile-soil interface that the finite element method is the most important numerical simulation analysis method in engineering practice and design. But in fact, due to the complexity of settlement analysis of pile foundation and many considerations, the finite element method is still limited to the analysis of the single pile and pile group with few piles, and there are also limitations. However, some finite element analysis results of the single pile and pile group have been accurately measured by the engineering and model test [6]. The stress in pile group foundation is formed by the load acting on the single pile diffusing in the foundation, so its stress is greater than that of single pile foundation. The elastic modulus of foundation is the same, so the settlement of pile group foundation is generally larger than that of single pile foundation. In engineering practice, the commonly used calculation methods of the pile group include equivalent action-layered summation method, settlement ratio method, and finite element method. The solid foundation model is the equivalent foundation removal method. It regards pile foundation as solid foundation and calculates pile group settlement according to shallow foundation without considering the effect of compression deformation between piles. Because of the damage to surrounding soil caused by compaction piles during construction, the theory of circular hole expansion and finite element method are widely used in practical engineering calculation. This study mainly uses these two methods to study the influence of compaction effect of pile driving on the surrounding building environment. In the pile foundation construction of high-rise buildings, there are two kinds of piles: precast pile and cast-in-place pile. This paper mainly analyses the pile-forming methods of the precast concrete pile and cast-in-place pile. The concrete pile refers to the pile made of ordinary reinforced concrete or prestressed concrete. There are two types of precast concrete piles: pipe pile and square pile. For example, prefabricated concrete pipe piles are usually produced by the centrifugal method in prefabricated factories. When prefabricated long piles are usually prefabricated near the construction site, the overlapping casting method is generally used. When making precast concrete piles, it is necessary to ensure the smoothness of the precast site and prevent uneven settlement of concrete piles. Isolation measures should be taken between piles to avoid bonding between piles or between piles and bottom moulds. Only when the strength of the underlying pile or adjacent pile is more than 30%, can the upper pile and adjacent pile be poured. When precast concrete piles are poured, they should be poured from the pile top to the pile tip in order to avoid interruption. Precast Concrete Pipe Pile. Generally speaking, cast-in-place piles are formed by sinking pipe or operation. Reinforcement cages are put into the pile holes completed by construction, and then, concrete pouring is carried out. When concrete pouring is completed, it is hardened, and then, the pouring construction of pile foundation is integrated. Pile sinking usually adopts the impact method or vibration method. Because these two methods will cause tremendous vibration when they are used, it is necessary to do a good job of protection before construction. In general, manual or mechanical drilling is used to drill holes, but when encountering clay, mechanical drilling is not suitable. When using manual drilling, attention should be paid to the drainage work. Construction Preparation. Before the start of construction, all kinds of garbage and waste in the construction site should be cleaned and tidied, so as to keep the construction site clean and level, provide favorable conditions for the construction of pile foundation of high-rise buildings, avoid the construction quality affected by the disorder and uneven site in the construction process, and ensure the stability and verticality of pile foundation of high-rise buildings. After site leveling, the laying-out construction should be carried out, and the axes of the construction site should be strictly checked. The construction personnel should accurately locate the control line according to the construction drawings and check whether each pile position is in a reasonable position repeatedly according to the requirements of the drawings, so as to avoid the occurrence of dislocation. In addition, we also need to prepare the machine and equipment needed for construction, place or install the machine and equipment in a reasonable position, and fix the drilling machine needed in this project in a reasonable position to ensure the reasonable pile position. The guard barrel is buried. After the preparatory work is done, the buried protective barrel should be carried out. Only by doing well the construction at this stage, can the collapse of the hole wall be avoided in the process of drilling. In order to ensure the quality of the construction, the steel protective barrel is adopted in this project. Mud Production. When drilling, mud can be used to cool drill bits and lubricate drilling tools and also to prevent the collapse of pile holes. The mud is generally composed of water, clay, and additives. After a certain proportion, the mud can be fully mixed to achieve the desired results. Drilling Construction. The drilling construction should be carried out in accordance with the preset sequence and strictly in accordance with the construction standards, so as to ensure that the center line and verticality are correct and avoid the phenomenon of hole deviation. In addition, it should also be noted that, in drilling, the predisposed slurry should be added continuously, and the slag discharge construction should be carried out in time. Cleaning construction. When drilling, the
diameter, depth, and location of the hole should be monitored in time. When the pile hole reaches the specified parameter standard, it should be cleared immediately to avoid the phenomenon of slurry precipitation due to long time. This will not only affect the construction quality but also may cause the collapse of the pile hole. The vacuum suction machine is used to clean the hole in this project. After the completion of the hole cleaning, the quality acceptance of the construction of cast-in-place piles at the above stage should be carried out. Only when the quality of each construction meets the requirements, can the construction of the next stage be continued. Installation of the Reinforcing Cage into the Hole. After the completion of the hole cleaning construction, the prefabricated steel cage is put into the hole for positioning and fixing. In the process of installation and construction of the steel cage into the hole, corresponding measures should be taken to prevent the deformation of the steel cage. The steel cage should be vertical into the pile hole to avoid the hole wall being damaged in the process of hoisting the steel cage. The length of suspension bars should also be calculated reasonably to ensure the installation and construction of steel cages into holes smoothly. When the installation of the reinforcing cage into the hole is completed, the depth of the hole and the thickness of the sediment in the hole should be measured. If it does not meet the requirements, the hole cleaning construction should be carried out again. Concrete Pouring. In order to avoid pile breakage and other phenomena, concrete pouring cannot be interrupted. In addition, it should be noted that, before concrete pouring, concrete mixing and mixing should be done well so that the water cement ratio, slump, workability, and initial setting time of concrete are within the prescribed range. Only by ensuring the quality of concrete, the quality of the cast-in-place pile can be guaranteed.

Based on the actual engineering background, a three-dimensional finite element model is established and the calculation of the excavation part of the foundation pit is carried out. By comparing the calculated results of the model with the measured results, it can be seen that the numerical results are close to the measured results, which shows that the assignment of geotechnical parameters is reasonable at this time. The influence of pile foundation settlement on surrounding buildings is analyzed. The results show that, with the construction, the surrounding buildings will crack and collapse of nearby tunnels. For the actual construction engineering, the construction loading of the superstructure is just a long process. In addition, the form of new building foundation in this paper is single and fixed, and the actual project needs to determine the form of foundation according to the geological survey report, so the paper does not consider the impact of different forms of foundation. Buildings are less affected by excavation of the foundation pit and pressure of static pressure piles in engineering construction. The current state of buildings is mainly due to differential settlement caused by adjacent buildings. In similar projects in the future, various factors affecting the use of buildings should be fully considered. During construction, cracks in surrounding buildings should be observed timely and accurately, so as to have a current state of existing buildings. Reasonable and accurate judgment rather than simply believing that pile settlement or construction will inevitably lead to damage to surrounding buildings.

2. Method

2.1. Static Pressure Sinking Pipe Cast-in-Place Pile. The construction method of pile foundation is the static pressure sinking pipe cast-in-place pile, so the compaction effect will be produced in the construction of pile foundation, and the vibration effect is small. It is not considered in the analysis. The influence of compaction effect on nearby buildings is mainly analyzed. The displacement and settlement data can be measured according to the benchmark points laid on the site and the measurement rules. The main object of this study is Jinjia compound in the construction area. Therefore, the measurement data of Jinjia compound are selected for analysis in this study. Because of the damage caused by compaction piles to surrounding soil during construction, it is possible to cause damage to adjacent buildings when construction is carried out in cities or adjacent buildings, such as ground cracking of adjacent buildings, tunnel collapse, and other consequences [7]. Therefore, this study needs to understand its damage mechanism and mode in the construction process and put forward some measures to reduce the damage to nearby buildings. The existing methods for studying soil compaction effect include the theory of circular hole expansion, finite element method, strain path method, slip line theory, and model trough test:

\[
\frac{d\sigma_r}{dr} + \sigma_r - \sigma_\theta \frac{\sigma_\theta}{r} = 0. \tag{1}
\]

The geometric equation is

\[
\varepsilon_r = \frac{d\sigma_r}{dr}, \tag{2}
\]

\[
\varepsilon_\theta = \frac{\sigma_\theta}{r}. \tag{3}
\]

The yield condition of soil is

\[
\sigma_r - \sigma_\theta = 2\mu. \tag{4}
\]

The boundary condition is

\[
\gamma = \gamma_0, \tag{5}
\]

According to formulas (1)-(3), the radius of the plastic zone can be obtained as follows:

\[
R_p = r_0 \sqrt{\frac{E}{2(1+\mu)}}. \tag{6}
\]

The boundary radial displacement of the plastic zone is
\[ u_p = -1 + \frac{\mu}{E_{cu}} R_p. \] (6)

The equilibrium differential equation and geometric equation of the element body can be obtained. Combined with the yield condition and boundary condition of the soil body, the maximum expansion stress of the pile-soil interface can be obtained as follows.

\[ pu = cu + \frac{2cu \ln R_p}{\gamma_0} = \left( \frac{\ln E_{cu}}{2(1 + \mu)} cu \right) + 1, \] (7)

where \( \gamma_0 \) is the radius of the expansion hole, \( R_p \) is the radius of the plastic zone, and \( \gamma \) is the distance from the center of the cylindrical expansion hole.

2.2. Finite Element Method. The finite element method is a computer simulation technology, which is essentially a numerical method for solving mathematical and physical equations. It combines elastic-plastic theory with computer science. The birth of the finite element method provides a powerful numerical calculation tool for solving practical engineering problems. The essence of the finite element method is to divide the complex continuum into a finite number of simple units, turn the wireless degree of freedom problem into a priority degree of freedom problem, and transform the problem of solving the (partial) differential equation of the continuous field function into the problem of solving algebraic equations with finite parameters. The basic idea of the finite element method is to divide a continuum into finite elements, that is to say, to take a structure as a whole composed of several elements connected by nodes, to carry out element analysis first, and then to combine these elements to represent the original structure for overall analysis. From a mathematical point of view, the finite element method is a method that transforms a partial differential equation into an algebraic system of equations and then solves them by computer. The implementation of finite element numerical simulation analysis can be divided into three stages. In the first stage (pretreatment), according to the actual engineering background, the whole structure or a part of the project to be simulated is transformed into a mathematical and physical model under ideal conditions, and then, the discretized finite element structural element is used to replace the transformed continuous solid structure model or a specific region to be solved; in the second stage (calculation and analysis), the finite element method is used to combine the two. In the third stage (postprocessing), the calculation results of the finite element software are derived and the results are sorted out, analyzed, and summarized. MIDAS/GTSNX (Geotechnical and Tunnel Analysis System) is a visual and intuitive modeling software for complex geometric models such as geotechnical and tunnel. Its unique multi-Frontal solver can provide us with the fastest computing speed. The software combines the general finite element analysis core with the professional requirements of the geotechnical tunnel structure and combines the advantages of the current geotechnical tunnel analysis software. The software mainly includes nonlinear elastic-plastic analysis, unstable seepage analysis, construction stage analysis, seepage-stress coupling analysis, consolidation analysis, seismic analysis, and dynamic analysis. In the postprocessing stage, it can automatically output concise calculation books in the form of tables, graphs, and charts. MIDAS/GTSNX software has been applied in many large-scale geotechnical and tunnel projects in the world with its full-Chinese cultural operation interface, intuitive and friendly pretreatment, diversified analysis functions, abundant material constitutive models, and concise and comprehensive postprocessing.

2.3. Simulation Experiment. The model test method is a research method, very similar to the hypothesis experiment method. But this unproven theory has been constructed as a model by researchers. Then, each part of the model is proved by experiments one by one. The model experiment refers to the entity experiment, which obtains relevant data and checks design defects by conducting corresponding experiments on scaled down or equal-ratio models. This is a research method, very similar to the hypothesis experiment method. But this unproven theory has been constructed as a model by researchers. Then, each part of the model is proved by experiments one by one, which is called the model test method.

3. Experiment

The main purpose of this study is that the site is located between Jiefang Pavilion and Shunjing Street in Lixia District of Jinan City, north of West Heihuquan Road, west of North Heihuquan Road, east of Shunjing Street, and south of Quancheng Road, covering an area of about 11.28 hm² (169.18 mu). Foundation pit excavation is needed in most areas of the project, with a depth of 6 – 9 m. Supporting piles are used to support the foundation pit. According to the site engineering geological conditions and the surrounding environmental conditions, the site soil parameters are shown in the table below.

According to the data in Table 1, these two methods are used to study the effects of pile driving and soil compaction on the surrounding building environment. The basic assumptions of the theoretical model of circular hole expansion are as follows: (1) the soil is a homogeneous and isotropic ideal elastic-plastic material; (2) the saturated soft soil is incompressible; (3) the effective stress of the soil is equal in all directions before small hole expansion. Equilibrium differential equation, geometric equation, soil yield condition, boundary condition, radius of plastic zone, and radial displacement of the plastic zone can be obtained according to the above conditions. The balanced differential equation and geometric equation of the unit can be obtained. Combining the soil yield conditions and boundary conditions, the maximum expansion stress of the pile-soil interface can be obtained. The results are shown in Figure 1.

According to Figure 1, we can see that based on the theory of circular hole expansion, the parameters and initial conditions of soil, the damage range of soil around piles can
be obtained, and the variation law of soil compaction can also be obtained by the conventional triaxial compression test \[8, 9\]. Among them, the excess pore water pressure produced by the instantaneous compaction process of pile driving and the increment of compaction stress are considered. When the volume is assumed to be compressed, it can be obtained. For different soils, \( A_f \) can take different values, clay can take 0.98, and silty clay can take 0.90, which can be substituted into the formula mentioned above, and the curve of stress variation along the radial direction of pile driving is drawn, as shown in Figure 2.

As shown in Figure 2, it can be seen that (1) the compressive stress is between radial stress and tangential stress; (2) the radial stress is the largest, and the tangential stress is the smallest in the numerical value; (3) on the outer boundary of the plastic zone, it is equal to the absolute value, but it is compressive stress and turns into tensile stress.

### 4. Results and Discussions

In high-rise buildings with pile foundation as foundation, not all pile foundations of high-rise buildings are piled raft foundation, and pile foundations without raft are widely used. Based on the examples mentioned above, this study carries out calculation and simulation analysis.

According to the simplified formula of the soil displacement field around piles derived from pile group settlement theory, the settlement value of ancient buildings can be obtained. In this study, the pile group is regarded as a single pile, and ancient buildings are regarded as “multiple points” of equalization. According to the calculation theory and formula of the pile group, the settlement values of three points with the same pile diameter \( L = 16, 18, 20, \) and \( 22 \) m are calculated, and the graph is drawn, as shown in Figure 3. From Figure 3, it can be seen that when the pile diameter of the high-rise building is the same, the longer the pile length, the smaller the settlement. With the increase of the distance between the ancient building and the pile foundation of the high-rise building, the settlement value tends to decrease, but the settlement value between the calculation points A7-A8 is larger than that on both sides. This is because the influence of the pile foundation on the south side of the ancient building is taken into account in the calculation, and the settlement value of each calculation point is based on the settlement superposition value caused by pile foundation in north and south side of Zhaogu building.

| Soil layer number | Soil name                | Average thickness of soil layer (m) | Modulus of elasticity (MPa) | Poisson ratio | Friction angle (degree) | Cohesion (KPa) |
|-------------------|--------------------------|-------------------------------------|-----------------------------|---------------|-------------------------|----------------|
| 1                 | Miscellaneous fill       | 0.5                                 |                             |               |                         |                |
| 2                 | Silty clay               | 1.3                                 | 25.7                        | 0.30          | 22                      | 10             |
| 3                 | Gravel-bearing silty clay| 2.2                                 | 22.4                        | 0.18          | 25                      | 12             |
| 4                 | Gravel                  | 2.5                                 | 104.0                       | 0.23          | 38                      | 2              |
| 5                 | Clay                     | 4.0                                 | 27.3                        | 0.35          | 13                      | 25             |
| 6                 | Residual soil            | 5.2                                 | 20.6                        | 0.30          | 12                      | 25             |
| 7                 | Totally weathered diorite| 13.8                                | 50.0                        | 0.25          | 10–50                   | 53–55          |
| 8                 | Strongly weathered diorite| 5.6                                 | 147.0                       |               |                         |                |
The overall height of the ancient building in this project is about 8 m. According to the simulation results, the inclination curves of the ancient building in different pile lengths of the pile foundation of high-rise buildings can be obtained, as shown in Figure 4. According to Figure 4, the longer the pile length, the smaller the inclination of the ancient building. When the pile length is longer than 22 m, the inclination of the ancient building is almost zero.

According to the numerical simulation, not only the settlement curve of ancient buildings caused by pile foundation settlement of high-rise buildings can be obtained but also the displacement of ancient buildings with different pile lengths under the same pile diameter. Figures 5 and 6 show that, with the increase of pile length, the displacement of ancient buildings decreases gradually. When pile length \( L = 22 \text{ m} \), the settlement of pile foundation of high-rise buildings has little effect on ancient buildings.

According to the data curve in Figure 6, when the pile length is 14 m, the displacement of the top is obviously larger than that of the bottom, and the downward trend of the top is also very fast.
5. Conclusion

The existing high-rise buildings in our country have made some achievements in the continuous development situation, but with the continuous improvement of people’s living standards, the analysis of various factors affecting the displacement of building foundations shows that the building is less affected by the excavation of the foundation pit and the pressing of static pressure piles in engineering construction. The main reason for its current state is the difference caused by adjacent buildings settlement. According to the field observation, no cracking occurred in the temporary construction wall which is closer to the excavation site and has poor stiffness, which also strongly proves this conclusion. In similar projects in the future, various factors affecting the use of buildings should be fully considered, and attention should be paid to timely and accurate observation of cracks in surrounding buildings before construction, so as to have a reasonable and accurate judgment of the current state of existing buildings and to judge the impact of surrounding buildings, rather than simply assuming that the construction of high-rise buildings is inevitable.

Data Availability

No data were used to support this study.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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