Common Problems in Stress Analysis of Concrete Cutoff Wall Based on Big Data Analysis

Long Ma*, Shixiang Cai, Zhenling Liu and Yingying Li
Huangzangsi Project Construction & Management Bureau, HRB, LanZhou, China

*Corresponding author e-mail: malong2012vip@126.com

Abstract. In order to ensure the safety of various buildings, the application of concrete cut off wall in various buildings is more and more extensive. The stress of cut off wall is directly related to the stability of the wall. At present, many scholars have made in-depth research on stress analysis of concrete cut off wall. With the development of big data analysis technology, it has been applied to stress analysis of cut off wall. With its application and further research, it can be found that there are some common problems in stress analysis of concrete cut off wall based on big data analysis, which affect the accuracy of analysis results. Therefore, it is urgent to study these problems in depth. Based on the analysis of big data, this paper collected and processed the stress data of cut off wall in detail, and obtained the common problems in stress analysis of concrete cut off wall with the help of clustering analysis algorithm, and put forward relevant improvement Suggestions on this basis. It not only guarantees the accuracy of the stress analysis results, but also has reference significance for the future related research.

Keywords: Big Data Analysis, Concrete Cut off Wall, Stress Analysis, Clustering Analysis

1. Introduction

At present, people pay more and more attention to the quality of various buildings. The waterproof penetration of buildings is related to the stability and safety of buildings [1-2]. Based on this situation, the application of concrete cut off wall in all kinds of buildings is becoming more and more extensive, and has become the most important means of anti-seepage in buildings. The concrete cut off wall is perforated with the help of special drilling equipment, and mud is injected into the slot hole. Concrete is poured into the slot hole to replace the mud originally poured into the slot hole, thus forming the cut off wall [3-4]. Compared with other impervious types, the impervious wall has many advantages, such as good impervious effect, adjustment according to the topographic structure at any time and sufficient mature technical support [5]. Based on these advantages, concrete cut off wall is more widely used. However, when the concrete cut off wall is in the process of impervious work, its specific stress situation is relatively complex, so accurate stress analysis on the concrete cut off wall is currently a difficult problem [6-7]. Therefore, it is particularly important to study the common problems in stress analysis of concrete cut off wall. Accurate stress analysis of concrete cut off walls requires a large
amount of data as support, and it is extremely difficult to collect massive data [8-9]. Due to the development of big data analysis technology, data collection is more convenient, which provides a better channel and means for the collection of stress analysis data of concrete cut off wall [10].

In the 1970s, the structural mechanics method showed an extremely significant role in the stress analysis of the concrete cut off wall. Since the 1980s, the stress analysis of concrete cut off walls is usually conducted by the finite element analysis method, and the results of stress analysis under this method have been greatly improved [11-12]. However, there is still a lack of data support, and the analysis results still lack certain accuracy. It can be seen that data collection and processing are directly related to the accuracy of stress analysis results of concrete cut off wall, which brings many problems to its stress analysis [13].

In order to make a more thorough and accurate study on the stress analysis of the concrete cut off wall, the existing problems in the stress analysis are solved. This paper collected and processed stress data of cut off wall in detail, and obtained common problems in stress analysis of concrete cut off wall with the help of clustering analysis algorithm, and proposed relevant improvement Suggestions on this basis [14-15]. On the one hand, it is beneficial to obtain relatively accurate stress analysis data.

2. Method

2.1 Overview of Big Data Analysis (BDA)

BDA is to deal with a large amount of data with the help of relevant mathematical algorithms, so as to predict the probability of events accurately. At present, BDA has been applied to various fields, and stress analysis of concrete cut off wall has also started to analyze with the help of BDA. The basis of BDA is data. With the help of current information technology, data collection is carried out. The result of BDA is proportional to the number of data. That is, the more data are collected, the more accurate the analysis results are. The essence of BDA is to store the collected data with the help of advanced cloud computing technology, and then process and analyze the data on this basis. The stress analysis of concrete cut off wall with the help of BDA must follow two principles: first, BDA must be supported by massive data to assure the accuracy. If the data samples used in the analysis are small, the results obtained from the analysis are not widely representative. Second, the pursuit of accurate data; the stress analysis of concrete cut off wall is relatively complicated and it is difficult to take into account every data. But as long as there is enough data, the impact of bad data is negligible.

2.2 Clustering Analysis Algorithm

Cluster analysis algorithm is a common data collection algorithm, which can effectively mine the required data. This algorithm can automatically analyze and process various original data of the concrete cut off wall according to the logical relationship between relevant data tables, and excavate the intrinsic value of the original data, so as to better serve the stress analysis of the concrete cut off wall. The stress analysis process of concrete cut off wall based on cluster analysis algorithm mainly includes three processes: data preparation, clustering and evaluation of results. In essence, the clustering of concrete cut off wall data belongs to the grouping expression of similar data. If P is set as rough attribute set, and there are m elements in this set, then the final clustering result will be 2m−1. Pi represents each clustering result, and its attribute set is Si. The specific calculation formula is as follows:

\[ S_i = S_{P}(P) - S_{P - P_i}(P) \]  
(1)

Where, SP(P) represents the importance determination function of cluster analysis, and Pi represents the set of attribute sets. When SP(P)=1, the specific calculation formula of sp-pi (P) is as follows:

\[ S_{P - P_i}(P) = \frac{cardPOS(P)}{cardU^S_i} \]  
(2)
In the above formula, the main degree of Si is proportional to the set of Pi attributes. The greater the importance of the attribute set, the greater the impact on the result of the data sample.

3. Stress Analysis experiment of concrete cut off wall

In order to make a comprehensive analysis of the stress of the concrete cut off wall, it is necessary to analyze the stress of the cut off wall in different stages, and draw a more scientific and accurate conclusion by comparing the stress in different periods. With the help of the above clustering analysis algorithm, the completion and use time of the concrete cut off wall are analyzed in detail.

Completion period of concrete imperious wall stress contour and contour lines are parallel, basically the size of the vertical stress distribution of diaphragm wall are also consistent with that by clustering analysis algorithm is concluded that the maximum stress of diaphragm wall are occurred in the top and the bottom, but appear under stress in the middle of the wall by the distance from the wall at the bottom of about a third place. It is found that this is mainly due to the effect of the friction resistance of the side wall. The stress distribution in the use period of the concrete cut off wall is basically the same as that in the completion period. However, due to the influence of water pressure in the use period, the maximum vertical stress value of the cut off wall appears at the bottom of the wall. And through relevant experimental tests, it is found that the vertical stress value is also increased compared with the completion date. However, its maximum stress and compressive strength are smaller than that of concrete.

4. Common Problems in Stress Analysis of Concrete Cut off Wall

According to the above stress analysis experiments, the following conclusions can be drawn: the stress analysis of the concrete cut off wall is very complex and is affected by a variety of factors. These factors will affect the accuracy and comprehensiveness of the stress analysis results, which is a problem that must be considered in the analysis process. Through the above experiments, it is found that the factors influencing the stress of cut off wall are not only the factors at different stages, but also the key to stress analysis are as follows: the wall structure of cut off wall, the physical characteristics of materials, the characteristics of the contact surface between the wall and the surrounding graph body, and the constraints of the wall end on the wall. It is feasible to analyze its stress with the help of big data, but accurate calculation of wall stress involves not only the contact model and parameters between the covered layer and the wall, but also the model and parameters of the wall itself. In general, the sensitivity of cut off wall stress to parameters is the most common problem. The specific experimental data are shown in table 1. In the table, K represents the parameters and S represents the friction Angle of the contact surface.

| Rate of Parameter Change(%) | S=10 | S=15 | S=20 | K1=2000 | K2=4000 | K3=8000 |
|-----------------------------|------|------|------|----------|----------|----------|
| Vertical Stress(MPa)        | 57.55| 61.46| 61.29| 52.05    | 61.46    | 64.10    |
| Stress Rate(%)              | -4.74| 0    | 1.4  | -15.3    | 4.3      | 4.3      |

*Data came from the in-depth analysis of financial data in the experiment*

According to the data in table 1, it can be seen that the influence of parameter K on the stress of cut off wall is greater than that of friction Angle of contact surface. When the friction Angle decreased to 32.3%, the stress decreased by only 4.7%. When the friction Angle increased to 61.29, the vertical stress value only increased to 1.4%. The influence of parameter K was greater, and the minimum stress value dropped to 15.3%. However, by analyzing the parameters, we can also find that the influence of increasing parameters on the stress of concrete cut off wall is less than that of decreasing parameters. When K was reduced by 50%, the maximum vertical stress was reduced by about 15.3%. When K increases by 100%, its stress increases by only 4.3%. Therefore, it can be seen that the
variation of the sensitivity of cut off wall to stress parameters is relatively complex, which requires a detailed and comprehensive analysis and consideration of different situations.

The mechanical characteristic parameter $G$ was expressed as 0.4, 0.45 and 0.5 respectively for cluster analysis, and the stress data of cut-off wall obtained were shown in figure 1.

![Figure 1. Effect of the change of parameter $G$ on vertical stress of cut off wall](image)

It can be seen from figure 1 that the change of mechanical characteristic parameter $G$ will have a certain impact on the stress analysis results, but the impact is relatively small. Since the change of $G$ has little impact on stress analysis, it is often ignored by people, thus affecting the scientific city and accuracy of stress analysis results and causing calculation errors.

5. Conclusion
The stress analysis of the concrete cut off wall is susceptible to interference from other factors, including the main structure of the cut off wall, the physical and mechanical properties of the wall material, and the specific characteristics of the contact surfaces between the wall and other walls. These problems must be paid attention to in the stress analysis of concrete cut off wall. Therefore, the stress analysis of cut off wall should be based on specific factors to choose a more appropriate analysis method, so as to obtain a more scientific and accurate stress analysis results.

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