Analysis of Factors Affecting the Compressive Strength of Cement Stabilized Gravel

Miao Yu¹, Xiangguo Chang¹ and Shasha Chen¹
¹School of Highway, Chang'an University, Xi'an 710064, China
Email: 772816532@qq.com

Abstract. The compressive strength of cement stabilized gravel is an important parameter of pavement base design and performance evaluation. In this study, the parameter selection of the compressive strength of cement stabilized macadam as the research direction, by collecting both the compressive strength of cement stabilized macadam mixture test data, establishing database of strength, obtain various parameters represent value under different reliability, analysis of specimen forming method, type of aggregate gradation and different influence factors such as the relationship between the compressive strength of the cement stable macadam mixture, using the mathematical regression method, set up under the condition of different curing ages, cement dose the prediction equation of intensity of verified the established logarithm model has higher fitting precision and can provide for pavement structure design and performance forecast value basis.

1. Introduction

Cement stabilized macadam base material is paving the main bearing layer under the surface in the road surface and at the grass-roots level, take on surface transfer driving vertical load, and the load evenly dispersed in the roadbed. Affected by various factors such as construction technology and construction environment, the influence of the easy occurrence crack in cement stabilized base construction process, segregation, partial loose, strength, smoothness and other defects, which affect the quality of pavement, caused the road all kinds of diseases. Existing specifications in core samples of the cement stable macadam mixture, the compressive strength evaluation of the compressive performance of cement stabilized macadam, but less research of compressive strength of the cement stable macadam mixture, selection, existing specifications involved is less.

This study on the compressive strength of the cement stable macadam mixture, values as the research direction, from the perspective of composition design, experimental conditions and the construction technology, on the compressive strength of cement stabilized gravel to sorting test data, the molding method and the aggregate gradation type compressive strength and the influence factors, such as correlation relationship. By comparing the compressive strength under different conditions, the strength prediction model was studied, and the analysis intensity was influenced by different factors. The values of compressive strength data are selected, which can be used as reference for experiments.

2. Data collection and analysis of compressive strength

2.1 Data collection of compressive strength

Through Chinese how net literature search engines, semi-rigid base as keywords retrieval all kinds of 83894 references, including all kinds of academic journal 33420, good bo 44715 master's degree theses, domestic and international conference of 1640 papers, after a preliminary screening of the
selection of which more than 7500 downloads, for data collection. Finally, there were 315 groups of compressive strength data, including 91 academic papers and 142 excellent journals at home and abroad.

2.2 General analysis of compressive strength data
The compressive strength of cement stabilized gravel is affected by many factors, and the data distribution is analyzed from different influencing factors.

![Figure 1. Cement stabilized gravel unconfined aging](image)

It can be seen from figure 1 that, from the perspective of gradation, the compressive strength data of cement stabilized crushed stone is mainly concentrated in 70.58% of the total amount of the skeleton compacted mixture. From the forming point of view, the compressive strength of the cement stabilized crushed stone is more than 70% of the total data, and the compressive strength data of the vibration-forming cement is about 30% of the total amount.
3. The data of compressive strength is determined by the value

3.1 Degree of reliability
Influenced by many factors, the pavement material parameters have a large variability, which has a great influence on the performance and service life of the road surface. At present, the pavement structure design of the reliability of the generally accepted the range of 80% to 99%, 90%, 95% and 97% this article selects three values of high reliability, in order to get high credible degree of intensity values.

3.2 The determination of fluctuation limit under unilateral
The strength of cement stabilized gravel base is too large, on the one hand, it can resist the crack performance and produce dry shrinkage and temperature shrinkage crack. , on the other hand, will cause the pavement structure design is unsafe, the actual strength of the pavement structure cannot meet the requirements, so choose strength or sample of unilateral fluctuation limit (unilateral confidence lower limit) as a representative of the intensity values.

By mathematical statistics, if the random variable X1, X2,... Xn is independent of the same distribution, and each random variable has a normal distribution N (μ,σ²), And \( T = \frac{\bar{X} - \mu}{S/\sqrt{n}} \) the degree of freedom is n -1of t-distribution, Use the distribution of T variables. It can be deduced that the confidence level of normal maternal average is 1- a:

\[
\mu = \bar{X} - t_{a}(n-1)\frac{S}{\sqrt{n}}
\]

\( \mu \) — Normal maternal mean, that is, strength or modulus.
\( \bar{X} \) — sample average.
\( S \) —sample standard deviation.
\( t_{a}(n-1)\) —The numerical value can be obtained by the upper part of T distribution.

4. The influence factors of unconfined compressive strength
Selection of cement stabilized macadam mixture compressive forming method of high performance influence degree and the aggregate gradation type four aspects, such as factors, through strength data contrast, analysis of the factors under the tendency of the compressive strength of the mixture.

4.1 Molding method
The influence of forming mode on strength is very significant, and the relationship between the forming mode and compressive strength is illustrated by taking the compressive strength of 7d cement stabilized gravel mixture as an example.
Figure 2. Cement stabilized gravel unconfined compressive strength and the way of forming of diagram

The figure 2 shows that Vibration molding under the condition of the compressive strength is greater than the compressive strength, static pressure molding conditions for GM type mixture vibration molding the compressive strength of the average is about 1.8 times that of the static pressure molding, for XM type mixture vibration molding the compressive strength of the average is about 1.52 times that of the static pressure molding, so the skeleton dense type cement stable macadam mixture, and use the vibration compaction specimen shape. It can be seen from this that the method of vibration molding can increase the strength significantly more than the cement dosage that increases the mixture.

5. Conclusions
Based on the analysis of the influence factors of the unconfined compressive strength of cement stabilized gravel mixture, the following conclusions are drawn:
(1) Combining with analysis and outlier data screening, classification, sorting out the method of calculating the strength of the representative values under different reliability, and analyze the
influence of different influence factors on the representative value degree, the analysis shows that the factors affecting the strength of cement stabilized macadam mixture are in line with the general law of experiment, the influence of selecting typical representative value.

(2) Analyze the influence of different influencing factors on the index of cement stabilized macadam mixture, and it can be concluded that the increase of cement stabilized gravel (before 28d) is large; at the same time, the strength increases with the increase of cement dosage. According to the specification, the representative value has certain accuracy and representativeness.

(3) Using different models to predict the strength of cement stabilized macadam mixture and the strength of the mixture and cement dosage and curing age the relationship between the change of the fitting, determine the has higher fitting precision of the cement stable macadam mixture strength prediction equation, has high reliability verification, for the strength of the cement stable macadam mixture parameter selection for reference.

6. References

[1] Sun Lijun Asphalt pavement structural behavior theory [M]. Beijing: people's traffic press, 2005:518-521.
[2] Wang Chunming, Xu Shifa, li ping. Cement stabilized gravel gradation optimization design and forming methods on the result of test specimen [J]. Journal of Beijing institute of architectural engineering. 2007 (3): 15-17
[3] Zhang Dewen Li Jun. Health way time-changing law influences the development of cement concrete strength [J]. Transportation standardization. 2014 (18): 1-3.
[4] Material Structure, 2000, 33 (226): 82-87. Jin Kai Ying Zhijun Cheng Yi should be the volunteers, Cheng Yi. Vibration method and static method in the application of the optimization of the mix proportioning of the cement stable macadam mixture [J]. Journal of heilongjiang institute of engineering. 2008 (01): 41-4
[5] Zhang Chaosheng Yu Shaobo, da-peng meng. [3] craghack coarse aggregate effect on flexural strength of road concrete [J]. Journal of shandong building materials. 2004, 25 (1): 44-45.
[6] Shen Jinan. Summary foreign asphalt pavement design method [M]. Beijing: people's traffic press, 2004: 1-255