






RESEARCH ARTICLE

REVISED A comparative study of red brick powder and lime as soft soil stabilizer [version 2; peer review: 2 approved, 1 approved with reservations]

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Abstract

Background: The role of soil in building construction is to support the loads above it. Different types of soil with poor mechanical properties require more attention. Therefore, more effort is needed to stabilize the soil by improving its properties. These improvements are intended to modify soil properties to improve engineering performance, such as strength, decrease in compressibility and permeability. This study aimed to compare the potential of lime and brick powder as stabilizers based on the California Bearing Ratio (CBR) values. Soil stabilization can be defined as modifying the soil properties by chemical or physical means to improve its engineering efficiency. The main objectives of stabilizing soil are increasing its bearing capacity, resistance to weathering processes, and permeability.

Methods: This work did laboratory tests with disturbed and undisturbed soil samples. The proportions of lime or red brick powder additives are 0%, 5%, 10%, and 15% of the soil sample. From the results of the laboratory tests, the soil type obtained is MH (low plasticity silt) as per the Unified Soil Classification System (USCS).


Results: This study showed that soft soil could be improved by adding lime and red brick powder as a soil stabilizer. In both soaked and unsoaked CBR tests, there was an increase in the CBR value for each proportion of the mixed additives. However, the red brick powder addition (15%) has significantly increased the CBR value.

Conclusions: The soil sample mixed with 15% red brick powder had the highest Maximum Dry Density (MDD), about 5.5% over untreated soil. The increment of lime to 15% has increased the CBR soaked by 61% in relation to untreated soil. The increment of red brick powder to 15% has increased the CBR unsoaked by 73% in relation to untreated soil.

Open Peer Review

Approval Status ? ✓ ✓

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version 1 09 Aug 2021	? view	↑ ? view	

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Keywords

Soft soil, lime, brick powder, CBR, hambalang



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REVISED Amendments from Version 1

1. The authors have been citing current literature dealing with similar investigations and highlighting the contribution of this work that differs from similar studies.
2. The authors state the sources and content of the additives used for soil stabilization.
3. Statements that are not directly related have been deleted.
4. All figures have been adjusted.
5. The conclusion has been rewritten based on the author's work.
6. The grammatical errors have been corrected.

Any further responses from the reviewers can be found at the end of the article

Introduction

Soil is considered to be a three-phase system consisting of soil particles, pores (air) between its particles, and liquid (water) which varying degrees, fills and flows through the pores.¹ Based on the particle size of soil, there are several types of soil, namely gravel, sand, silt, clay.² The large content of silt and clay in soil affects its geotechnical characteristics that can vary: shrink when dry, and expand when wet; in the presence of water, they swell and become plastic.³ Constructions such as buildings, highways, bridges, tunnels, dams, and towers are established on the ground that functions to support the loads above it.⁴ Engineers often have problems using soft soil, which has; weak mechanical properties. Soft soil is a cohesive soil consisting of very small grains, characterized by low shear strength and high compressibility, which does not possess sufficient strength to support loads. It is necessary to treat these soils to provide a stable subgrade and avoid excessive land subsidence. A soil is categorized as soft soil if its shear strength value is 12 – 25 kPa.⁵

For these reasons, soft soils need treatment before they can be used as a material subgrade by enhancing their engineering properties. Soil stabilization aims at improving soil properties and increases its resistance to softening by water. In principle, it means rearranging soil grains for them to be very tight and interlocked together.^{6,7} The stabilization process, which is mixing soil with additives, can change the texture or plasticity of soil, its gradation, or act as a binder for soil cementation.⁸

In recent years, a considerable number of field and laboratory experiments have been carried out using various additives, such as lime,^{9–11} silica fume,¹² and fly ash.^{13,14} However, not much research has been done on soil stabilization using red brick powder as a soil stabilizer.^{15,16} Moreover, every red brick manufacturer knows its history, which does not always have the same characteristics. This could indicate differences in the test results at every location.¹⁷ Therefore, it is necessary to do more research on the effect of red brick powder on soil stability. Also, the stabilizing effect of lime and red brick powder are compared in this work. The influence of lime on the geotechnical qualities of soft soil was examined by conducting the CBR test. The CBR values for the soil mixture progressively increased.^{18,19} Similar outcomes were observed by Refs. 20–22 when employing waste brick powder as a soil stabilizer.

The study aims to compare the potential of lime and brick powder in stabilizing soft soil. Soil stabilization parameters were measured based on their effect on the CBR values of soaked and unsoaked soil samples. This test is a penetration test which entails inserting an object into the test object. Through this way, the strength of the base or other materials used to make the pavement can be assessed. As soil is not always in a dry condition, it would not be enough to do the CBR test with unsoaked soil samples; it must be done also with soaked soil. Soaking simulates adverse moisture conditions such as those caused by possible rain or flooding, and it is used in most CBR test. The difference between the soaked and unsoaked CBR testing procedure is that in the soaked CBR, the soil sample that has been molded is first soaked for 4 days (96 hours) by placing a standard load of 10 lb above the mold and then penetration test is carried out afterward. The mixed proportions of lime or red brick powder are 0%, 5%, 10%, and 15% by dry weight of the soft soil. In this study, the index and engineering properties of the soft soil and treated soil were tested. Index properties test includes testing moisture content, specific gravity, Atterberg limit, and grain size analysis. While testing the soil with a variation of the mixture of lime or red brick powder, the standard compaction test and CBR analysis are carried out.

Lime is commonly used as additional material for soil stabilization, especially for the construction of highways. Lime reacts with soil and changes its mineral properties. This is due to its reaction with calcium ions, which leads to the formation of cementitious holding capacity of soil (decreases moisture content), reduced swelling, and improved soil stability.²³ Previous studies^{24,25} revealed that the stabilization of subgrades by lime could significantly improve their engineering properties. Using lime for soil stabilization gives long-term strength gain, developed through a long-term pozzolanic reaction.²⁶

Alumina and silica are the main elements in brick obtained from the combination of clay and sand, which are the main ingredients for making bricks. After the mixture of clay, sand, and water becomes plastic and easy to form, the brick is burned at a high temperature until a reddish colour is obtained. It cannot be broken down when immersed in water. Red brick has refractory properties and can withstand compressive loads.²⁷ There are scanty research works that have used red brick powder as a stabilizer because it is not commonly used. Each area has different red brick characteristics. Previous research has found that CBR results substantially improved the primary strength parameters of soil by using brick powder.²⁸

Methods

Material and sampling

The type of soil used in this research is soft soil located in *Hambalang, Bogor*. The rock that makes up the area at the top is in the form of Quaternary volcanic breccia; it is less compacted, with its surface utterly weathered into sandy clay. Its colour is gray-brown, it is soft and 0.30-1.50 meters thick. In the breccia unit, the localities have lenses or inserts that are flaky, swollen, stiff, partially scraped, and soft when exposed to the surface. Their colour is gray to brownish-gray. **Figure 1** shows a systematic geological map of Bogor, Indonesia.²⁹ The green area is the sampling location used in this study, where the surficial deposits show clay shale.

Experimental technique

The method used in this research is a descriptive method, with tests conducted in the laboratory. Soil samples were taken in October during rainy season near the project site of the homestead of Athlete Hambalang, Bogor, Indonesia. Its geographical coordinates are 6°33'14.5"S and 106°53'22.1"E. Soil sampling was taken from a depth of 1 m to approximately 200 kilograms. Soil materials used for the test were disturbed and undisturbed soil samples. The undisturbed soil sample was used for dry density and engineering properties testing. The test was applied to identify the existing soil. Also, several stages of the laboratory tests were carried out with the disturbed samples. The laboratory test included (i) index properties of soil test, (ii) standard Proctor compaction test, and (iii) soaked and unsoaked CBR test. Index properties of soil test included specific gravity, sieve analysis, hydrometer test, and Atterberg limit used to determine the classification of soil. Before the compaction and CBR test was started, the soil sample was dried and filtered

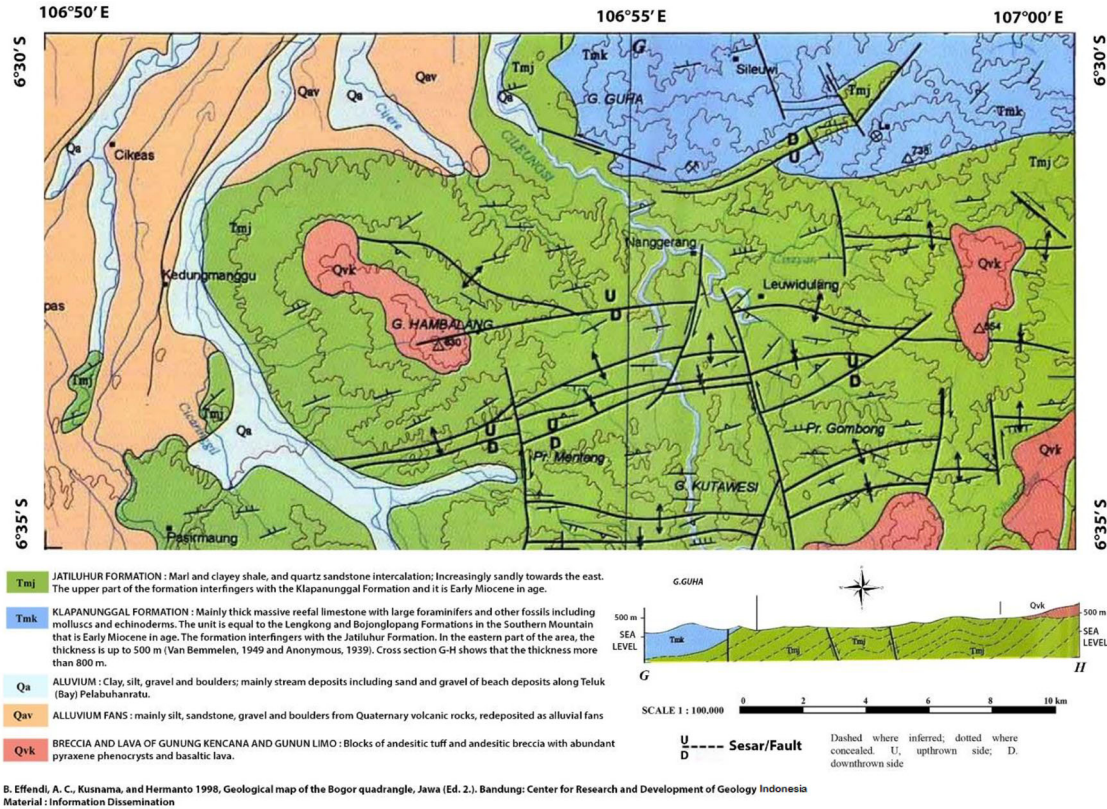


Figure 1. Systematic geological map of Hambalang, Bogor, Indonesia.²⁹ It is reproduced with permission from the Head of the Geological Survey Institute of Indonesia.

with sieve number 4 (smaller than 4.75 mm). Also, lime and brick powder were filtered with sieve number 40 (smaller than 0.475 mm). Lime were obtained from Klapanunggal District, Bogor, West Java and brick powder were obtained from the waste generated by brick industries in the Bogor area. The additives were mixed as a percentage of 0%, 5%, 10%, and 15% of soft soil ratio by weight. In the Standard Proctor test, each mixture of the additives required 6 samples with the composition of each sample being 2 kg of soil mixed with either lime or brick powder, based on the percentage determined by each sample. Each percentage of the mixture has 6 samples where the total sample is 48 for lime and brick powder. Furthermore, the Standard Proctor test was carried out to obtain optimum moisture content (OMC) and maximum dry density (MDD) for each mixed sample of the various proportions of lime and brick powder. The CBR test compares the resistance to penetration of the test specimen to that of a standard sample of well-graded crushed stone material using a standard-sized piston in a simple empirical approach. CBR test is one of the ways used to measure the bearing capacity of subgrades.³⁰ Based on the OMC obtained from the standard Proctor test, we could use the OMC for the next stage, that is, to conduct the soaked and unsoaked CBR test with various mixtures of the additives. Each mixture of the additives required 2 samples, with the composition of each sample being 5 kg of soil mixed with lime or brick powder, based on the percentage determined by each sample. So for each soaked and unsoaked CBR test, 8 samples are needed. CBR tests were carried to study the behavior and bearing capacity of the soil when mixed with the additives (lime and brick powder). After molding the soil shape, each soil samples used for the soaked CBR test was soaked in water for 4 days (96 hours), before the penetration test. While in the unsoaked CBR test, no soaking was carried out, but a direct penetration test. The sample was left in the mold to be used for penetration test. The piston was placed on the sample with the perforated plate and the necessary surcharge weights were place on the soil. Loading began at a rate of 0.05 in (12.7 mm) per minute. Test loads were recorded at eleven predefined depths of up to 0.500in as the piston entered the soil (13 mm). All these tests are also referred to as ASTM standards.^{31–36} Manufacturers of the dial gauge equipment used Mitutoyo analog type.

Statistical analysis

Statistical analysis using 2nd order polynomial regression was done on the moisture content and dry density data. The software used was Microsoft Excel 2019. Polynomial relation regression results show quadratic regression function and coefficient of determination (R^2). The coefficient of determination is a statistical measurement that shows how much ability the independent variable has in explaining the dependent variable. A value close to 1.0 indicates a regression function that explains a lot of the function variable. This makes it a very reliable model for forecasting the future. While a value close to 0.0 indicates that the calculation fails to simulate the data accurately.

Results and discussion

The physical and mechanical properties of the soil can be seen in [Table 1](#).³⁹ The soil samples contained more than 95% fine-grains, with size smaller than 0.075 mm. Based on the results, *Hambalang* soils can be classified as soft soils with high plasticity (symbol MH based on the Unified Soil Classification System) due to their undrained shear strength of >25 kPa. Also, in a previous report, the Department of Settlements and Regional Infrastructure classifies *Hambalang* soil as fat clay because it has a high swelling potential.

[Figures 2](#) and [3](#) show the relations between moisture content against the dry density for the various proportions of lime and brick powder obtained from the compaction test. The figures also show the influence of lime and brick powder on the OMC of the soil.

Lime and brick powder have notable effect on the soil's MDD in all the mixed samples. The highest is observed in the samples with 15% additive, where the value increased from 1.58 for the soil not mixed to 1.7 for the soil mixed with 15% lime and 1.68 for the soil mixed with 15% brick powder. These were obtained at OMC of 21.12% for brick powder and 21.06% for lime. Optimum moisture in the compaction test was used as a mixture in the CBR test. The MDD of the soil samples increased because lime and brick powder have relatively higher specific gravities than soil. When the proportion of lime and brick powder increases, the MDD of the soil increases compared to the soil. The increase in water content at MDD conditions can be seen in [Figures 2](#) and [3](#). This can occur because of the pozzolanic reaction, which causes the maximum density conditions to require a little more water.

As seen in [Figure 4](#), the MDD of the mixture of lime and brick powder is at the 15% additive level. The increase in dry bulk density (γ_d) was due to additional material filling the cavities in the soil, decreasing the pore number. A decrease in the incidence of an increase in soil density leads to an increase in dry density.

The CBR soaked and unsoaked tests were carried out with the soil from lime and red brick powder at predetermined levels (5%, 10%, and 15%) by observing any changes in the CBR value at the top and bottom. The relationship between the addition of lime and red brick powder to the soil on the CBR values of soaked and unsoaked is shown in [Figure 5](#).

Table 1. Properties of soil.

Parameters	Unit	Value
A. Index properties		
Moisture Content	%	33.6
Specific Gravity (Gs)	%	2.67
Liquid Limit	%	58.3
Plastic Limit	%	41.8
Plasticity Index	%	16.5
Dry density	kN/m ³	1.58
B. Grain size distribution		
% Gravel	%	0
% Sand	%	4.55
% Silt and Clay	%	95.45
C. Engineering properties		
Triaxial UU		
Q	-	12.47
Undrained shear strength	kPa	17.9
E. Classification		
USCS	-	MH
F. Bearing capacity		
CBR Soaked at (MDD)	%	3.5
CBR Unsoaked at (MDD)	%	15.7

Triaxial UU = unconsolidated undrained test is compression test, in which the soil specimen is subjected under isotropic all-round pressure in the triaxial cell before failure is brought about by increasing the major principal stress. MDD = maximum dry density.

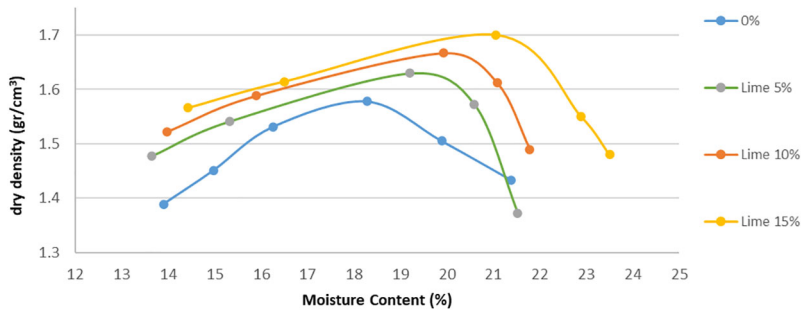


Figure 2. Moisture content vs dry density stabilized with lime.

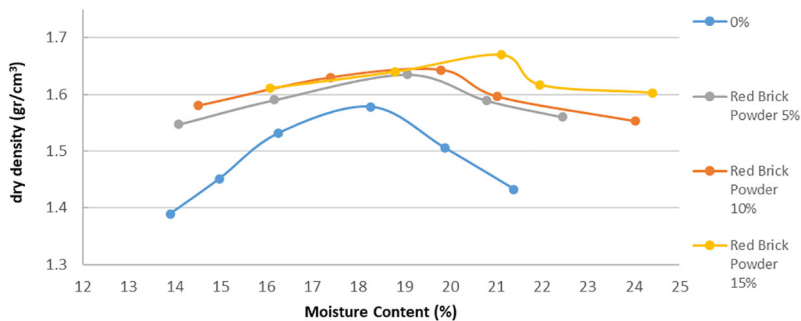


Figure 3. Moisture content vs dry density stabilized with red brick powder.

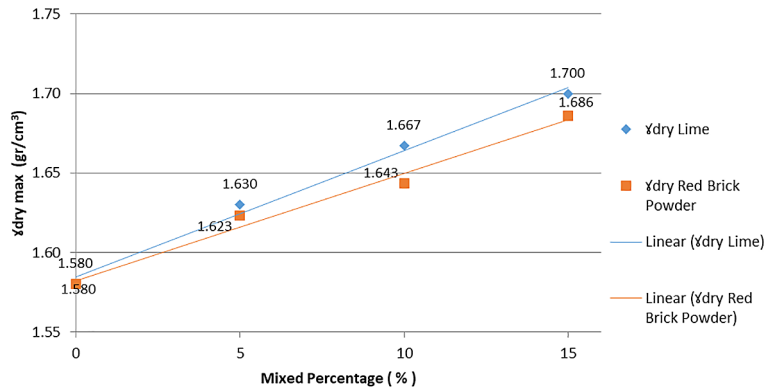


Figure 4. The dry density of the soil with different additive levels.

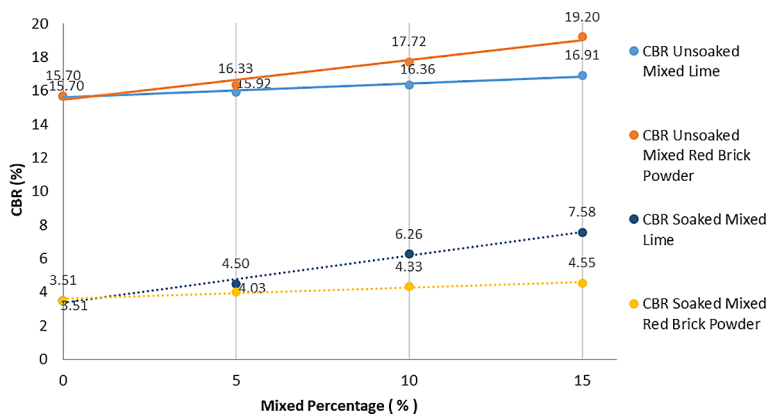


Figure 5. CBR soaked and unsoaked values.

The results of the test data on the discovery of CBR values that were soaked and unsoaked increased with the addition of lime or red brick powder. This is because the soil grains and additives react with one another in a process known as pozzolanization reaction. In treated soil, the strength generated is determined by the strength of the grain and the friction between the grains. So, the increased strength of the soil is not only a pozzolanization reaction but also friction between grains. This finding agrees with another result, which explained the strength of mixed soils in different cases.³⁷

The highest CBR value of lime and red brick powder is found in the 15% mixture. The CBR-soaked result for lime has a higher value (7.58%) than that of brick powder (4.55%). While the CBR unsoaked result of red brick powder has the highest CBR value (19.2%) compared to lime (16.91%).

The CBR soaked value is smaller than the CBR unsoaked value because, at the time of immersion, the water initially fills the pore cavities. Over time, the size of the soil grains expands to their maximum when the water is saturated. In these conditions, the bonds between the soil grains become weak so that the bearing capacity of the soil decreases. This result is similar to another finding which showed that the more saturated the soil is, the less its bearing capacity.³⁸

The increase in CBR value is due to the cementation process, which makes the soil clump, thus increasing the binding power between the grains. This makes the pore cavity to be surrounded by a more rigid cementation material, which results in the grains becoming strong and not easily destroyed.²⁴

Conclusions

This study examined lime and red brick powder in a few geotechnical engineering applications to improve the strength of soft soil. The soft soil samples have undertaken a thorough laboratory test, including Specific gravity, Sieve analysis, Hydrometer test, Atterberg limit, Proctor test, and CBR. The soft soil mixed with lime and red brick powder (0%, 5%, 10%, and 15% by dry weight of the soft soil). The MDD of the soil sample increases when mixed in various proportions of lime and red brick powder. The soil sample mixed with 15% of additives had the highest MDD. The increment of red brick

powder into the soil progressively caused an increase in MDD by 5.5% when the red brick powder ratio was increased to 15%. The soaked and unsoaked CBR values increased with lime and red brick powder variation. The highest CBR soaked value is obtained from a lime mixture of 15%. The increase is 61% over that of the untreated soil. The highest CBR unsoaked value is obtained from a 15% addition of red brick powder. The increase is 73% over that of the untreated soil.

Data availability

Underlying data

Zenodo: A comparative study of red brick powder and lime as soft soil stabilizer (Dataset). <https://doi.org/10.5281/zenodo.5028251>.³⁹

This project contains the following underlying data:

- CBR soaked and unsoaked 10(percent) Mixed with Lime.xlsx
- CBR soaked and unsoaked 15(percent) Mixed with Lime.xlsx
- CBR soaked and unsoaked 5(percent) Mixed with Lime.xlsx
- CBR soaked and unsoaked resume value mixed percentage.xlsx
- CBR soaked and unsoaked soil.xlsx

Data are available under the terms of the [Creative Commons Attribution 4.0 International license](https://creativecommons.org/licenses/by/4.0/) (CC-BY 4.0).

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1. General comments:

The article titled "A comparative study of red brick powder and lime as soft soil stabilizer", authored by Aisyah Salimah *et al.*, presents a practical study aimed at understanding the laboratory tests with disturbed and undisturbed soil samples where the proportions of lime or red brick powder additives are 0% up to 15% of the soil sample. In general, the topic is of great interest and is well within the scope of the journal. The authors have provided a significant contribution that is sufficiently performed and interesting for readers. They used an appropriate method to address the objectives, and the obtained results are both interesting and relevant. The findings were successfully explained in the manuscript, and most of the references used are related to the objective of the work. The scientific contribution of this paper highly meets the requirements of the journal F1000Research.

2. Abstract section:

The abstract effectively provides a brief overview of the study's background, methods, and results. The language used is clear and concise, with technical terms explained where necessary, making it easy to understand for readers without prior knowledge of the topic. The abstract follows a structured approach, starting with the study's background and objectives, followed by the methods and results, and ending with conclusions. This helps readers quickly understand the main purpose and outcomes of the study. Overall, the abstract is well-written and effectively conveys the main findings of the study.

3. Introduction section:

In the introduction section of this scientific paper, the author extensively discussed the characteristics of soft soil with weak geotechnical properties, as well as the importance of studying it before undertaking any civil engineering project. The author touched on the most important numerical models developed by researchers regarding geotechnical projects in general, and shallow tunnels modeling in particular, based on studies conducted and published in relevant scientific journals. The author relied on several important references related to the subject matter. The introduction is clear in terms of linguistic structure, where we find that the problem is completely clear.

4. Methods section:

The authors conducted a rigorous experiment using a variety of tests to assess the effectiveness of the two different stabilizers. Their findings suggest that the method used in the study is not only appropriate but also highly effective in improving the strength and stability of soft soil, which has important implications for construction projects in areas with problematic soil conditions." This sentence highlights the fact that the authors used a rigorous approach in their study, which involved various tests to assess the effectiveness of the stabilizers. Additionally, the sentence emphasizes that the method used is not only appropriate but also highly effective, which is a strong endorsement of the validity of the research findings. Finally, the sentence suggests that the implications of the research are significant for construction projects in areas with problematic soil conditions, which adds further weight to the importance of the study.

The statistical analysis performed on the moisture content and dry density data was useful, which indicates that the use of 2nd order polynomial regression with Microsoft Excel 2019 software is a meticulous approach to the data analysis process. The inclusion of the coefficient of determination (R^2) is noteworthy as it provides crucial insight into the explanatory power of the independent variable with respect to the dependent variable. The successful calculation of the quadratic regression function and R^2 value highlights a significant correlation between the two variables, making the regression model a dependable tool for predicting future trends. In conclusion, this "statistical analysis" establishes a robust foundation for the statistical analysis of the data, and the results can be interpreted confidently to derive meaningful insights.

5. Results and discussion section:

That said, the article is a well-written and informative piece of research that successfully presents the findings of the study. The authors have clearly outlined their methodology and have presented the results in a manner that is both comprehensive and accessible to readers. Overall, the article is a valuable contribution to the field of soft soil stabilization and provides important insights into the effectiveness of different stabilizers in enhancing soil strength and stability." The authors provide a detailed discussion section that highlights the significance of their findings and their implications for future research and practical applications. The discussion section begins by summarizing the key results of the study, emphasizing the effectiveness of both red brick powder and lime as soft soil stabilizers. The authors then provide an in-depth analysis of their findings, discussing the various factors that may have contributed to the effectiveness of the stabilizers, including their chemical composition and particle size. In addition to discussing their own research, the authors also reference previous studies on soft soil stabilization, providing a broader context for their findings and highlighting areas where further research is needed. They also

discuss the practical applications of their research, such as the potential use of red brick powder and lime in construction projects to improve the stability and safety of buildings and infrastructure in areas with problematic soil conditions. Overall, the discussion section of the article is well-written and thorough, providing a detailed analysis of the study's findings and their implications for the field of soft soil stabilization. The authors' ability to contextualize their research within existing literature and to provide practical applications for their findings is a testament to the strength of the study and the potential impact it could have on future research and real-world applications.

6. Conclusion section:

Based on this section, the authors have effectively summarized the key findings of the study in a concise and clear manner. The conclusion begins by stating the aim of the study, which is to investigate the effectiveness of lime and red brick powder as soft soil stabilizers. The authors then highlight the various laboratory tests that were conducted to evaluate the performance of the stabilizers, including Specific gravity, Sieve analysis, Hydrometer test, Atterberg limit, Proctor test, and CBR. The authors then proceed to summarize the key findings of the study, noting that the addition of lime and red brick powder to soft soil samples resulted in an increase in MDD (Maximum Dry Density) and CBR (California Bearing Ratio). They further note that the highest values of MDD and CBR were obtained with a 15% addition of the respective stabilizer. The authors provide specific percentages of increase in CBR values over the untreated soil for both soaked and unsoaked conditions, which suggests a significant improvement in soil strength with the addition of stabilizers. Overall, the conclusion section effectively highlights the key results of the study and their significance for the field of geotechnical engineering. The authors have effectively communicated their findings in a clear and concise manner, which adds to the strength and clarity of the article.

However, based on the above comments, the present paper "A comparative study of red brick powder and lime as soft soil stabilizer" can be Approved for indexing as it is

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Geotechnical Engineering and Soil Improvement

We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 08 August 2022

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Reginald B. Kogbara 

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The article has been satisfactorily revised.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Stabilization/solidification of problematic soils and wastes, subgrade soil stabilization using polymers, characterization, and utilization of cement-based materials.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 22 June 2022

<https://doi.org/10.5256/f1000research.30780.r138934>

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**Reginald B. Kogbara** ¹ Mechanical Engineering Program, Texas A&M University at Qatar, Doha, Qatar² Department of Environmental Engineering, İzmir Institute of Technology, İzmir, Turkey³ Mechanical Engineering Program, Texas A&M University at Qatar, Doha, Qatar⁴ Department of Environmental Engineering, İzmir Institute of Technology, İzmir, Turkey

The paper concisely describes experiments aimed at investigating the effect of lime and red brick powder on soft soil stabilization. Specifically, its use of red brick powder for soil stabilization allows for beneficial reuse of what might otherwise be a waste material for soil stabilization. Hence, the work is scientifically valid and contributes to knowledge in the area of soil stabilization. The experimental design is appropriate and the work is technically sound with sufficient details that allow replication of the work by others, and the conclusions made are supported by the results of the study.

Major Points:

- The authors should better put the work into context by citing current literature that deal with similar investigations and highlighting the contribution of this work that is different from what was done in similar studies. For example, see Blayi *et al.*, (2020)¹; Srikanth Reddy *et al.*, (2018)²; and Bhavsar *et al.*, (2014)³
- Could the authors please state the sources of the lime and red brick powder used for the soil stabilization?

Minor Points:

- It would have been more helpful if compressive strength data was included to facilitate comparison with data in other studies related to the use of lime and waste brick powder for soil stabilization.
- The authors should explain clearly the expression “Statistical analysis using 2nd order polynomial regression was done”, stating the specific dataset the polynomial regression was applied on. For example, was the polynomial regression done on the moisture content – dry density data?

References

1. Blayi R, Sherwani A, Ibrahim H, Abdullah S: Stabilization of high-plasticity silt using waste brick powder. *SN Applied Sciences*. 2020; **2** (12). [Publisher Full Text](#)
2. Srikanth Reddy S, Prasad A, Vamsi Krishna N: Lime-Stabilized Black Cotton Soil and Brick Powder

Mixture as Subbase Material. *Advances in Civil Engineering*. 2018; **2018**: 1-5 [Publisher Full Text](#)
3. Bhavsar SN, Joshi HB, Shrof PK, Patel AJ: EFFECT OF BURNT BRICK DUST ON ENGINEERING PROPERTIES ON EXPANSIVE SOIL. *IJRET*. 2014; **3** (4). [Reference Source](#)

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Stabilization/solidification of problematic soils and wastes, subgrade soil stabilization using polymers, characterization, and utilization of cement-based materials.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 10 November 2021

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The authors have conducted laboratory investigation to improve CBR of silty soil by using red brick

powder and lime. The authors stabilized fine grain soil with and brick powder. The CBR values improved up 15 % addition of red brick powder. They could satisfy their objective. Not much information is generated. The reason for improvement in strength. The chemical composition of Brick Powder, Gradation etc. are missing. If it is only for pavement then only CBR improvement may not be sufficient as per new codes. Within the presented data the following pros and cons are observed. The suggested modification along with grammar check may help in improving the quality of paper.

The Text should be written in third person - 'I' and 'we' should not be there.

Abstract:

Statement: Soil has an important role to play in planning buildings because it supports the loads above it.

- Comment: May be corrected as 'Role of soil in building construction...'

Statement: Soil stabilization can be defined as the process of stabilizing soil properties by chemical or physical means to improve its engineering efficiency.

- Comment: Can be corrected as 'process of modifying the soil properties....'

Introduction:

Statement: Therefore, it is necessary to do more research on the effect of red brick powder on soil stability. Also, lime and red brick powder are compared in this work. The impact of lime and red brick powder on the geotechnical qualities of soft soil was examined by conducting the CBR test.

- Comment: Modify the sentences as 'Also, the stabilizing effect of lime and red brick powder are compared in this work. The influence of lime and red brick powder on the geotechnical qualities of soft soil was examined by conducting the CBR test'.

Statement: The CBR value increased because the soil structure changed from being dispersed to flocculated. Thus, in this study, lime and brick powder were used as stabilizers on soft soils.

- Comment: Remove the above statements.

Statement: In this study, the index and engineering properties of the original soil and mixed soil were tested.

- Comment: Remove the term 'original' and may be replaced with term either 'soil or silty soil or untreated soil' wherever applicable in the manuscript.

Statement: Literature review

- Comment: Literature review can be combined with introduction part.

Methods:

Statement: The proportions of lime or red brick powder additives mixed together are 0%, 5%, 10%, and 15% of the original soil sample.

- Comment: Can be corrected as 'The proportions of lime or red brick powder additives mixed are 0%, 5%, 10%, and 15% with the soil'.

Statement: From the results of the laboratory tests, the soil type obtained is MH soil based on the Unified Soil Classification System (USCS). The MH soil type is a low plasticity silt soil.

- Comment: Can be corrected as 'The soil type obtained is MH (low plasticity silt) as per the Unified Soil Classification System (USCS)'.

Material and sampling:

- Comment: Properly described.

Experimental technique:

Statement: proctor, atterberg

- Comment: Capitalize first letter as 'Proctor', 'Atterberg'

Statement: CBR, and other abbreviations

- Comment: All abbreviations are to be used at the first appearance throughout the manuscript.

Results and discussion:

Statement: However, red brick powder had a significant increase of 15%.

- Comment: Can be corrected as 'However, red brick powder addition has contributed to a significant increase in CBR value (15%)'.

Statement: Table 1

- Comment: Atterberg limits, CBR need to be indicated without decimals. Moisture contentment can be represented with 1 decimal. For Parameter % sand, unit %, value 4.55%, include correction as - Parameter sand, unit %, value 4.55. Make corrections wherever applicable in the manuscript.

Statement: Figure 2, 3 and 4

- Comment: Check x and y axes titles and units and incorporate correction (uniform writing style and standard units are to be used).

Statement: Lime and brick powder have high effect on the soil's maximum dry density (MDD) in all the mixed samples.

- Comment: Instead of term 'high effect' use 'significant' or 'notable effect'.

Statement: Figure 5

- Comment: Correction to be incorporated for CBR values.

Statement: Description of Results and discussion.

- Comment: Description has grammatical errors. It could be improved. Needs modification.

Conclusions:

Statement: This study found a very large range of variations because of the many material requirements for each test. We suggest other researchers perform the CBR test by reducing the range of variations in the additives to get firm data and using our experimental procedure in this study for further research.

- Comment: Authors need to draw conclusions on your work. Suggestions are not needed. Rewrite conclusions.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Pavement Materials, Concrete Pavement

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

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