1. Analysis on Compressive Strength of Concrete Using Different Sources of Fine Aggregates

January 2020

[**Sajedur Rahman**](https://www.researchgate.net/profile/Sajedur-Rahman?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19)

Rahman, S. (2020). *Analysis on Compressive Strength of Concrete Using Different Sources of Fine Aggregates*. [online] ResearchGate. Available at: https://www.researchgate.net/publication/338548502\_Analysis\_on\_Compressive\_Strength\_of\_Concrete\_Using\_Different\_Sources\_of\_Fine\_Aggregates [Accessed 26 Mar. 2024].

(Rahman, 2020)

Aggregates strongly affect the concrete's freshly mixed and hardened properties, mixture proportions, and economy. The utilization of fine aggregates of four local sources such as Sylhet, Rangamati, Rangunia, and Kalurghat on concrete compressive strength is investigated in this paper. Four separate mix designs were conducted targeting 3000 psi concrete for these four sources of fine aggregates. Total 12 concrete cylinders of 4 inches diameter and 8 inches height were cast for compressive strength test by using ordinary Portland cement which was previously tested for specific gravity. For each source of fine aggregates, three cylindrical samples were cast for different curing periods of 7, 14 and 28 days. The cylinders were tested in Universal Testing Machine of 1000 kN capacity against the consecutive curing periods. Overall, the concrete cast with Sylhet sand showed improved compressive strength compared to others. The 28 days compressive strength was found as 2862 psi for concrete cast with Sylhet sand, which was 12.51%, 15.65% and 31.27% more than concrete cast with Rangamati, Rangunia, and Kalurghat sand respectively. The results were then linked against the fineness modulus of the fine aggregates. Concrete compressive strength decreased as the fineness modulus of fine aggregates decreased. INTRODUCTION The standing of using the true quality and types of aggregates on concrete casting cannot be exaggerated. Among the aggregates used in concrete, fine aggregates have a vital impact on concrete strength. Bu et al. (2017) showed the effect on the compressive, flexural and split tensile strength of cement mortars using 4 sand content. By changing the sand content and water/cement ratio, the pore structure of cement mortar was studied. The test results showed that the strength of cement mortar increases with increasing sand content up to an extent. The sand content was found to be an important parameter influencing the pore structure of cement mortar. The relationship between the pore structure and strength of cement mortar was found to be good.

# Experimental and theoretical investigation on the bond strength between high-strength and lightweight concrete

# February 2024

# [Ahmed Eisa](https://www.researchgate.net/profile/Ahmed-Eisa?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19)

Eisa, A., Aboul-Nour, L.A. and Mohamad, A. (2024). *Experimental and theoretical investigation on the bond strength between high-strength and lightweight concrete*. [online] ResearchGate. Available at: https://www.researchgate.net/publication/377993550\_Experimental\_and\_theoretical\_investigation\_on\_the\_bond\_strength\_between\_high-strength\_and\_lightweight\_concrete [Accessed 26 Mar. 2024].

(Eisa, Aboul-Nour and Mohamad, 2024)

The appropriate bond strength between the layers with different concrete strengths is considered the most important concern for the layered elements. An experimental study has been approved to produce structural lightweight concrete with a compressive strength not decreasing by 18 MPa and a unit weight not increasing by 2000 kg/m³ and high-strength concrete with a compressive strength not decreasing by 60 MPa and then investigate the bond strength between new high-strength concrete and old lightweight concrete with different treatment cases and different compressive concrete strengths. Mix with 0% perlite meets the requirements of the targeted high-strength concrete, and mixes with 30%, 40%, and 50% perlite meet the requirements of the targeted structural lightweight concrete, and they can be used for testing bond strength with different treatment methods. The new concrete jackets have a concrete strength of 62.5 MPa, and the old concrete cube's strength is varied between 18.4, 21.8, and 38.08 MPa. A total of eleven bond strength test specimens were cast with different parameters. The specimen interface was arranged by different systems: roughness, agent material, and nails. The roughness techniques used were hand-wire brushing, grinding, or hand chiseling. Theoretical results were compared with the experimental data. It was concluded that using a new high-strength concrete with two times the strength of the old lightweight concrete and treating it with nails is the best technique to achieve an economic and acceptable value of bond strength. The nails achieved a good bond between the fresh and hardened concrete owing to the developed shear friction. The hand-chiseling roughness method gives the best bond strength results. The high difference in concrete strengths between the fresh high-strength jackets and the hardened lightweight cube isn’t mandatory to enhance the interface bond strength between them. Keywords: Bond strength; lightweight concrete; nails; agent material; high-strength concrete.

1. Statistical Analysis of Compressive Strength of Concrete

February 2024

[**Sujeet Kumar Mahato**](https://www.researchgate.net/scientific-contributions/Sujeet-Kumar-Mahato-2273760320)

Sujeet Kumar Mahato and Kumar, A. (2024). *Statistical Analysis of Compressive Strength of Concrete*. [online] ResearchGate. Available at: https://www.researchgate.net/publication/378149940\_Statistical\_Analysis\_of\_Compressive\_Strength\_of\_Concrete [Accessed 26 Mar. 2024].

‌ (Sujeet Kumar Mahato and Kumar, 2024)

Concrete is used in the construction practice as it is easily available, cheap, has flexibility of handling and can be shaped in any form desired. The use of concrete in the construction industry is now being done for a very long time. It is the most used material in the parts of structure where compressive strength is required. So in the construction process evaluation of the compressive strength of concrete plays a vital role. There is no universal method for the evaluation of the compressive strength. In India, the method prescribed by IS 456:2000 is used for checking whether the concrete made is fulfilling the requirement. An attempt is made to analyses this method statistically. The characteristic strength of the concrete is represented by test results of concrete cubes at 28 days. The compressive strength of concrete in India is defined based on this characteristic compressive strength. The sampling process of the concrete which is based on the amount of work of concrete to be done is studied and a trend between the number of samples and the failure percentage of samples in terms of compressive strength is studied. The concept of population and sample in terms of the concrete mix design is studied. Hypothesis testing is performed on various groups of samples and their deviation from the population is calculated. An attempt to calculate optimal number of samples for testing and an improvised method using statistics as a tool for checking the compressive strength of concrete is made.

1. Prediction of compressive strength of concrete based on IABC-MLP algorithm

January 2024

[**Ping Li**](https://www.researchgate.net/scientific-contributions/Ping-Li-2234883860)**,** [**Yanru Zhang**](https://www.researchgate.net/scientific-contributions/Yanru-Zhang-2257819167?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19)**,** [**Jiming Gu**](https://www.researchgate.net/scientific-contributions/Jiming-Gu-2257816608)**,** [**Shiwei Duan**](https://www.researchgate.net/scientific-contributions/Shiwei-Duan-2244144464)

Li, P., Zhang, Y., Gu, J. and Duan, S. (2024). *Prediction of compressive strength of concrete based on IABC-MLP algorithm*. [online] ResearchGate. Available at: https://www.researchgate.net/publication/377308680\_Prediction\_of\_compressive\_strength\_of\_concrete\_based\_on\_IABC-MLP\_algorithm [Accessed 26 Mar. 2024].

‌ (Li et al., 2024)

There are many factors that affect the compressive strength of concrete. The relationship between compressive strength and these factors is a complex nonlinear problem. Empirical formulas commonly used to predict the compressive strength of concrete are based on summarizing experimental data of several different mix proportions and curing periods, and their generality is poor. This article proposes an improved artificial bee colony algorithm (IABC) and a multilayer perceptron (MLP) coupled model for predicting the compressive strength of concrete. To address the shortcomings of the basic artificial bee colony algorithm, such as easily falling into local optima and slow convergence speed, this article introduces a Gaussian mutation operator into the basic artificial bee colony algorithm to optimize the initial honey source position and designs an MLP neural network model based on the improved artificial bee colony algorithm (IABC-MLP). Compared with traditional strength prediction models, the ABC-MLP model can better capture the nonlinear relationship of the compressive strength of concrete and achieve higher prediction accuracy when considering the compound effect of multiple factors. The IABC-MLP model built in this study is compared with the ABC-MLP and particle swarm optimization (PSO) coupling algorithms. The research shows that IABC can significantly improve the training and prediction accuracy of MLP. Compared with the ABC-MLP and PSO-MLP coupling models, the training accuracy of the IABC-MLP model is increased by 1.6% and 4.5%, respectively. This model is also compared with common individual learning algorithms such as MLP, decision tree (DT), support vector machine regression (SVR), and random forest algorithms (RF). Based on the comparison of prediction results, the proposed method shows excellent performance in all indicators and demonstrates the superiority of heuristic algorithms in predicting the compressive strength of concrete.

# Machine Learning Techniques in Concrete Mix Design

[Patryk Ziolkowski](https://www.scienceopen.com/search#author/24280a80-c5d7-4339-9106-b9c5e8f0bfa4)[\*](https://www.scienceopen.com/document?vid=ebae715f-850c-4e92-96c2-e16ca652c238#c1-materials-12-01256), [Maciej Niedostatkiewicz](https://www.scienceopen.com/search#author/c605d268-aed5-43db-b4fa-52f9fe393e46)

17 April 2019

Ziolkowski, P. and Maciej Niedostatkiewicz (2019). Machine Learning Techniques in Concrete Mix Design. *Materials*, [online] 12(8), pp.1256–1256. doi:https://doi.org/10.3390/ma12081256.

‌ (Ziolkowski and Maciej Niedostatkiewicz, 2019)

Concrete mix design is a complex and multistage process in which we try to find the best composition of ingredients to create good performing concrete. In contemporary literature, as well as in state-of-the-art corporate practice, there are some methods of concrete mix design, from which the most popular are methods derived from The Three Equation Method. One of the most important features of concrete is compressive strength, which determines the concrete class. Predictable compressive strength of concrete is essential for concrete structure utilisation and is the main feature of its safety and durability. Recently, machine learning is gaining significant attention and future predictions for this technology are even more promising. Data mining on large sets of data attracts attention since machine learning algorithms have achieved a level in which they can recognise patterns which are difficult to recognise by human cognitive skills. In our paper, we would like to utilise state-of-the-art achievements in machine learning techniques for concrete mix design. In our research, we prepared an extensive database of concrete recipes with the according destructive laboratory tests, which we used to feed the selected optimal architecture of an artificial neural network. We have translated the architecture of the artificial neural network into a mathematical equation that can be used in practical applications.

# Cement and Concrete as an engineering material: an historic appraisal and case study analysis

# May 2014

[**C. R. Gagg**](https://www.researchgate.net/profile/C-Gagg?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19)

Gagg, C.R. (2014). *Cement and Concrete as an engineering material: an historic appraisal and case study analysis*. [online] ResearchGate. Available at: https://www.researchgate.net/publication/260439461\_Cement\_and\_Concrete\_as\_an\_engineering\_material\_an\_historic\_appraisal\_and\_case\_study\_analysis [Accessed 26 Mar. 2024].

‌ (Gagg, 2014)

Today, second only to water, concrete is the most consumed material, with three tonnes per year used for every person in the world. Twice as much concrete is used in construction as all other building materials combined. There is little doubt that concrete will remain in use as a construction material well into the future. However, with such extensive use of the material, discovery of any shortcoming or problem associated with concrete or reinforced concrete structures will become a matter of considerable public concern - both from a safety perspective and associated costs of rectification. Accordingly, this paper will initially review the historic development of cements and concrete and will then focus on the mechanical response of concrete and reinforced concrete to its working environment. At appropriate points within the narrative, case study input will be used to illustrate or highlight principal themes.

# Experimental Investigation on the Compressive Strength of Concrete With Different Sizes of Coarse Aggregate

# 12 Dec 2020

## [**D. Pradeep Kumar**](https://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=4431637)**,** [**Abraham Biable**](https://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=4431638)

Kumar, D.P. and Biable, A. (2020). *Experimental Investigation on the Compressive Strength of Concrete With Different Sizes of Coarse Aggregate*. [online] Social Science Research Network. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract\_id=3713640.

‌ (Kumar and Biable, 2020)

The grading of aggregates is an important factor in the preparation of concrete and its compression strength. This experimental investigation was conducted to find the impact of different aggregate sizes on the compressive strength of the concrete. The aggregates used in this experiment was 8 mm and 11.2 mm size. The concrete of M 25 grade and the water-cement ratio of 0.4 was used for this experiment. Tests were done on the concrete making materials, on the fresh concrete and hardened concrete. The fresh batches of concrete prepared from each of the coarse aggregate sizes were collected, and the slump test for the collected batches was conducted to determine the workability. In total, 24 concrete cubes of size 150 mm × 150 mm were cast and cured for 28 days. The cubes, after 28 days of curing, were tested in compression testing machine to determine the compression strength of the concrete. The results showed that the workability of the concrete was directly proportional to the aggregate size. And also, the compressive strength increased with an increase in aggregate sizes.

1. Comprehensive study of biomass fly ash in concrete: Strength, microscopy, kinetics and durability

December 2007

Shuangzhen Wang ⁎, Larry Baxter ⁎

Wang, S. and Baxter, L. (2007). Comprehensive study of biomass fly ash in concrete: Strength, microscopy, kinetics and durability. *Fuel Processing Technology*, [online] 88(11-12), pp.1165–1170. doi:https://doi.org/10.1016/j.fuproc.2007.06.016.

‌ (Wang and Baxter, 2007)

ASTM (American Standard Testing and Materials) C 618 prohibits use of biomass fly ash in concrete. This document systematically investigates the strength, microscopic study and durability (mitigation of Alkali Silica Reaction (ASR) expansion) of biomass fly ash concrete (cement partially replaced by fly ash) and kinetics of the mixture of biomass fly ash and calcium hydroxide. The biomass fly ash in the investigation comes from cofired (herbaceous with coal) fly ash, which includes different kinds of coal and biomass. All the results show that biomass fly ash with cofiring concentration within the interest to commercial coal–biomass cofiring operations at power plants have equal or much better performances than those of coal fly ash; therefore, the exclusion of biomass fly ash in concrete by ASTM C 618 seems inappropriate and more quality research on the applicability of biomass fly ash in concrete should be conducted.

1. The effect of natural sand composition on concrete strength

June 2016

[S. Hasdemir](https://www.scienceopen.com/search#author/fd6e96fa-48f7-46d9-92ae-cd85fc3bf48e), [A. Tuğrul](https://www.scienceopen.com/search#%7B%22id%22%3A%22%22%2C%22context%22%3Anull%2C%22kind%22%3A77%2C%22order%22%3A0%2C%22orderLowestFirst%22%3Afalse%2C%22query%22%3A%22%22%2C%22filters%22%3A%5B%7B%22kind%22%3A34%2C%22query%22%3A%22A.%20Tu%C4%9Frul%22%7D%5D%7D), [M. Yılmaz](https://www.scienceopen.com/search#author/4453bc70-9fde-4a59-8f23-623e73e1a724)

S. Hasdemir, A. Tuğrul and M. Yılmaz (2016). The effect of natural sand composition on concrete strength. *Construction and Building Materials*, [online] 112, pp.940–948. doi:https://doi.org/10.1016/j.conbuildmat.2016.02.188.

(S. Hasdemir, A. Tuğrul and M. Yılmaz, 2016)

Natural sands show a variety of mineralogic compositions and chemical characteristics; when sand is used in concrete aggregate, these properties may result in different concrete strengths. However, there is little data about the effects of different sand aggregates on concrete strength. In this work we highlight some mechanical aspects regarding the use of sand from different origins such as concrete aggregate. The sand samples were first tested to determine their mineralogic and chemical characteristics and their aggregate properties. Then, concrete test samples were prepared using these aggregates, and the properties of the fresh and hardened concrete were determined. The results show that although all the samples were found to be suitable for use as fine aggregate in high-strength concrete production, natural sands that contained smectite-type clays have poor aggregate quality compared with other sands. Conversely, the chemical composition of the natural sand samples, especially the Na2O content, is important for predicting the strength properties of hardened concrete.

1. Study of Compressive Strength of Various Grades of Concrete using Different Sizes of Cubes

July-2015

Rajiv Banarjee, Md. Abid Alam, Zeeshan Ahmad

Banarjee, R., Alam, M. and Ahmad, Z. (n.d.). *Study of Compressive Strength of Various Grades of Concrete using Different Sizes of Cubes*. [online] Available at: https://www.ijert.org/research/study-of-compressive-strength-of-various-grades-of-concrete-using-different-sizes-of-cubes-IJERTV4IS070455.pdf.

‌ (Banarjee, Alam and Ahmad, n.d.)

Concrete being the most versatile material of construction holds the property of stronger in compression. This property enables the concrete for most of its utility in construction. Since the strength of concrete is related to the structure hardened cement paste, it assumes more importance. The size of test specimens for compressive strength is prescribed in relevant codes, however it varies from country to country and often more than one size is permitted.The restraining effect of the platens of the testing machine extends over the entire height of a cube but leaves unaffected a part of a test cylinder. It is, therefore, to be expected that the strengths of cubes and cylinders made from the same concrete differ from one another. It is difficult to say which type of specimen, cylinder or cube, is 'better' but, even in countries where cubes are the standard Specimen, there seems to be a tendency, at least for research purposes, to use cylinders rather than cubes.In the present investigation the effect of different cube size on compressive strength of concrete have been studied. The variations have been made in the size of specimen, grade of concrete & age of concrete. Four different sizes of specimen viz: 150 mm, 125 mm, 100 mm & 75 mm were used. A total of 4 mixes were prepared by varying the grade of concrete mixes. Based on the laboratory results the compressive strength was reported to increase with the decrease in specimen size. Moreover the relative strength of concrete were obtained and it was found that it also increases with the decrease in specimen size and remains unaffected due to age and grade of concrete.

‌

Literature review for each abstract:

Literature Review for Abstract 1:

The research investigates the influence of fine aggregates from various local sources on the compressive strength of concrete. Aggregates play a crucial role in determining concrete properties. Bu et al. (2017) explored the impact of sand content variation on cement mortar strength, highlighting the importance of sand content in influencing pore structure and strength. Their findings emphasized the relationship between sand content and cement mortar strength, with an observed increase in strength with higher sand content up to a certain extent. This underscores the significance of fine aggregates in determining concrete strength. Moreover, the study relates the compressive strength of concrete to the fineness modulus of fine aggregates, revealing a decrease in strength as the fineness modulus decreases. This suggests that the characteristics of fine aggregates significantly affect concrete strength. Therefore, understanding the properties of fine aggregates from different sources is crucial for optimizing concrete mix designs and achieving desired compressive strengths.

Literature Review for Abstract 2:

The research focuses on investigating the bond strength between high-strength and lightweight concrete layers, crucial for layered structural elements. Previous studies have emphasized the importance of achieving appropriate bond strength between layers with different concrete strengths. The study proposes various treatment methods to enhance bond strength, including using nails and optimizing surface roughness. These methods aim to improve shear friction and promote interlayer bonding. Notably, the study suggests that a significant disparity in concrete strengths between layers may not be essential for enhancing bond strength. This underscores the importance of surface preparation techniques and treatment methods in achieving adequate bond strength between concrete layers, contributing to the structural integrity of layered elements.

Literature Review for Abstract 3:

Concrete's compressive strength evaluation is essential in construction, with various methods employed worldwide. The study focuses on statistically analyzing the compressive strength evaluation method prescribed by IS 456:2000 in India. It examines the relationship between the number of concrete samples tested and their failure percentage concerning compressive strength. Additionally, the study explores population and sample concepts in concrete mix design and conducts hypothesis testing on sample groups. By employing statistical analysis, the study aims to determine optimal sample sizes for testing and proposes an improved method for checking concrete compressive strength. This underscores the importance of statistical techniques in enhancing the accuracy and efficiency of concrete strength evaluation methods.

Literature Review for Abstract 4:

Predicting concrete compressive strength is complex due to various influencing factors. The study proposes an improved algorithm, the IABC-MLP model, for predicting concrete compressive strength. This model combines the artificial bee colony algorithm (IABC) with a multilayer perceptron (MLP) neural network to capture the nonlinear relationship between compressive strength and multiple factors effectively. Previous empirical formulas for strength prediction lack generality and accuracy. In contrast, the IABC-MLP model demonstrates higher prediction accuracy by considering the compound effect of multiple factors. The research highlights the superiority of heuristic algorithms in predicting concrete compressive strength, emphasizing the potential of the proposed model for practical applications in the construction industry.

Literature Review for Abstract 5:

Concrete mix design is a crucial process in construction, with compressive strength being a key parameter. Machine learning techniques offer promising advancements in optimizing concrete mix designs. The study utilizes artificial neural networks and data mining techniques to predict concrete compressive strength accurately. By analyzing extensive databases of concrete recipes and laboratory tests, the research develops optimal neural network architectures for predicting compressive strength. This highlights the potential of machine learning in enhancing concrete mix design processes, enabling more efficient and reliable construction practices.

Literature Review for Abstract 6:

Concrete is one of the most widely used construction materials, but its extensive use raises concerns regarding potential shortcomings and structural issues. The study provides a historical overview of cement and concrete development, emphasizing their significance in construction. Additionally, it focuses on the mechanical response of concrete to its environment, highlighting the importance of understanding concrete behavior for ensuring structural integrity and safety. Through case studies, the research illustrates key themes and challenges in concrete engineering, emphasizing the need for continual improvement and research in the field.

Literature Review for Abstract 7:

Aggregate grading significantly influences concrete compressive strength. The study investigates the impact of different coarse aggregate sizes on concrete strength. It demonstrates a direct relationship between aggregate size and concrete workability and compressive strength. Previous research has shown that larger aggregate sizes generally result in higher compressive strength. Understanding the relationship between aggregate size and concrete properties is crucial for optimizing concrete mix designs and ensuring desired performance in construction applications.

Literature Review for Abstract 8:

Biomass fly ash, despite its potential as a supplementary cementitious material, faces limitations in concrete applications due to existing standards. The study systematically evaluates the strength, microstructure, durability, and kinetics of biomass fly ash concrete. Results indicate that biomass fly ash performs comparably or even better than coal fly ash, suggesting its suitability for concrete applications. The research underscores the need for further investigation and reconsideration of existing standards to leverage the potential of biomass fly ash in enhancing concrete properties.

Literature Review for Abstract 9:

The mineralogical and chemical composition of natural sands significantly influences concrete strength. The study examines the mechanical aspects of using sands from different sources as concrete aggregates. It identifies the importance of sand composition, particularly smectite-type clays, in determining aggregate quality and concrete strength. Understanding the properties of natural sands is essential for optimizing concrete mix designs and ensuring desired performance in construction applications.

Literature Review for Abstract 10:

Concrete strength is crucial for structural integrity, with test specimen size influencing compressive strength evaluation. The study investigates the effect of different cube sizes on concrete compressive strength. Previous research has shown variations in compressive strength based on specimen size, with smaller specimens often exhibiting higher strength. Understanding the relationship between specimen size, concrete grade, and age is essential for accurate strength evaluation and concrete mix design optimization in construction applications.

‌Literature review in a paragraph:

The research encompassed various facets of concrete strength assessment and optimization. Investigations delved into the influence of fine aggregates from different local sources, highlighting the crucial role of aggregates in determining concrete properties. Additionally, studies emphasized the significance of achieving appropriate bond strength between layers of high-strength and lightweight concrete, proposing various treatment methods for enhancing interlayer bonding. Furthermore, concrete compressive strength evaluation methods were statistically analyzed to determine optimal sample sizes and propose improved evaluation techniques. Predictive models, such as the IABC-MLP algorithm, showcased superior accuracy in forecasting concrete compressive strength, leveraging heuristic algorithms and neural networks. Machine learning techniques were also explored for optimizing concrete mix designs, utilizing artificial neural networks and data mining to predict compressive strength accurately. The historical development of cement and concrete, along with mechanical responses to environmental factors, underscored the importance of continual research and improvement in concrete engineering. Moreover, investigations into aggregate grading and natural sand composition highlighted their significant impact on concrete strength, necessitating a thorough understanding for optimal mix designs. Finally, the effect of specimen size on compressive strength evaluation underscored the importance of considering specimen characteristics in concrete testing protocols.

‌

Same as above but seggregated to find which line is from which number.

"The research covered various aspects of assessing and optimizing concrete strength. It looked into how different local sources of fine aggregates affect concrete properties, emphasizing the pivotal role of aggregates in this regard." - Abstract 1

"Moreover, the studies emphasized the importance of achieving the right bond strength between layers of high-strength and lightweight concrete, suggesting different methods to improve interlayer bonding." - Abstract 2

"Additionally, there was a statistical analysis of methods used to evaluate concrete compressive strength, aiming to find the best sample sizes and propose better evaluation techniques." - Abstract 3

"Predictive models like the IABC-MLP algorithm were highlighted for their accuracy in predicting concrete strength, utilizing heuristic algorithms and neural networks." - Abstract 4

"Furthermore, the exploration of machine learning techniques in optimizing concrete mix designs was notable, using artificial neural networks and data mining to accurately predict compressive strength." - Abstract 5

"The historical development of cement and concrete, alongside their responses to environmental factors, underscored the ongoing need for research and improvement in concrete engineering." - Abstract 6

"Furthermore, the studies into aggregate grading and natural sand composition shed light on their significant impact on concrete strength, emphasizing the importance of understanding them for optimal mix designs." - Abstract 9

"Finally, the examination of specimen size's effect on compressive strength evaluation highlighted the importance of considering specimen characteristics in concrete testing protocols." - Abstract 10

After paraphrasing in quillbot:

"The study examined several areas of measuring and optimising concrete strength. It investigated how various local sources of fine aggregates impact concrete characteristics, highlighting the critical importance of aggregates in this respect." - 1. "Moreover, the studies emphasised the importance of achieving the right bond strength between layers of high-strength and lightweight concrete, suggesting different methods to improve interlayer bonding." - Part 2 "Additionally, there was a statistical analysis of methods used to evaluate concrete compressive strength, aiming to find the best sample sizes and propose better evaluation techniques." - Part 3: "Predictive models like the IABC-MLP algorithm were highlighted for their accuracy in predicting concrete strength, utilising heuristic algorithms and neural networks." - Abstract #4"Furthermore, the exploration of machine learning techniques in optimising concrete mix designs was notable, using artificial neural networks and data mining to accurately predict compressive strength." - Summary:5 "The historical development of cement and concrete, alongside their responses to environmental factors, underscored the ongoing need for research and improvement in concrete engineering." - The abstract reads:6 "Furthermore, the studies into aggregate grading and natural sand composition shed light on their significant impact on concrete strength, emphasising the importance of understanding them for optimal mix designs." - Summary (9) "Finally, the examination of specimen size's effect on compressive strength evaluation highlighted the importance of considering specimen characteristics in concrete testing protocols." - Abstract 10.

Final Literature review:

The study examined several areas of measuring and optimising concrete strength. It investigated how various local sources of fine aggregates impact concrete characteristics, highlighting the critical importance of aggregates in this respect (Rahman, 2020). Furthermore, the research emphasised the need of attaining the appropriate bond strength between layers of high-strength and lightweight concrete, and they proposed several strategies for improving interlayer bonding (Eisa, Aboul-Nour and Mohamad, 2024). A statistical study of concrete compressive strength measurement methods was also conducted, with the goal of determining the optimal sample sizes and proposing improved evaluation methodologies (Sujeet Kumar Mahato and Kumar, 2024). Predictive methods, such as the IABC-MLP algorithm, were praised for their accuracy in forecasting concrete strength by combining heuristic algorithms and neural networks (Li et al., 2024). Furthermore, the use of machine learning approaches to optimise concrete mix designs was noteworthy, with artificial neural networks and data mining being used to effectively estimate compressive strength (Ziolkowski and Maciej Niedostatkiewicz, 2019). The historical evolution of cement and concrete, as well as their reactivity to environmental conditions, demonstrated the continual need for study and improvement in concrete engineering (Gagg, 2014). Furthermore, research into aggregate grading and natural sand composition revealed their major influence on concrete strength, emphasising the need of knowing them for appropriate mix design (S. Hasdemir, A. Tuğrul and M. Yılmaz, 2016). Finally, the study of the influence of specimen size on compressive strength evaluation demonstrated the need of include specimen features in concrete testing methods (Banarjee, Alam and Ahmad, n.d.).

Introduction:

Concrete, one of the world's most produced material, is structural material made of a hard, chemically inert particle component known as aggregate (often sand and gravel) that is formed by the interaction of cement and water which cures overtime (Concrete | Definition, Composition, Uses, Types, & Facts | Britannica, 2024). When making a building, houses or any structure, it is very important to know the compressive strength of the concrete to make it more durable and last long. The strength of the concrete mainly depends on the amount and quality of the material (Cement, fly ash, Water, Coarse aggregate, etc.) mixed to make it. The use of data analysis or machine learning for knowing the compressive strength of the concrete have all contributed to the progress of concrete mix designs.

Concrete | Definition, Composition, Uses, Types, & Facts | Britannica. (2024). In: *Encyclopædia Britannica*. [online] Available at: https://www.britannica.com/technology/concrete-building-material [Accessed 30 Mar. 2024].

‌