WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

A Review Paper on Experimental Investigation on Influence Size Of Aggregates In Concrete

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Abstract

This study investigates the influence of aggregate size and type on the mechanical properties of concrete, with a particular focus on compressive and flexural strengths. A mixed-methods approach was employed, combining quantitative surveys and qualitative interviews, to provide a comprehensive understanding of the communication practices related to material choices across various organizational levels. The research emphasizes the importance of both the size and type of aggregates, such as limestone, granite, and quartzite, on concrete performance. Specific properties, such as gradation, specific gravity, and void content, were analyzed to assess their impact on the strength and workability of concrete. The experimental program also considers the use of local materials, such as natural aggregates from the Ganderbal District of Jammu and Kashmir, in promoting sustainable and eco-friendly construction practices. The study concludes that optimal concrete performance can be achieved through a careful selection of aggregate size, type, and treatment, with quartzite providing the highest compressive strength, while the use of unwashed gravel or large aggregates may compromise the workability and durability of the concrete.

Keywords: Size of Concrete, Types of Aggregates.

Introduction:

The performance of concrete is highly dependent on the properties of the aggregates used, such as size, type, and gradation. Aggregates, which constitute most of the concrete's volume, play a crucial role in determining its strength, durability, and workability. Researchers and engineers have long studied the effects of different aggregate types (e.g., limestone, granite, quartzite, river gravel) and sizes on concrete properties to optimize its performance for various applications. The compressive strength of concrete is significantly influenced by the type of coarse aggregate, with quartzite generally producing superior results compared to other aggregates. Similarly, gradation, or the distribution of aggregate sizes, impacts both strength and workability, with smaller aggregates improving compressive strength due to better particle interlock. Larger aggregates, while enhancing compressive strength, can reduce workability and homogeneity, making them less suitable for certain applications. This study seeks to expand the current understanding of the relationship between aggregate size and concrete performance. It investigates various parameters such as specific gravity, uncompacted void content, and the effect of washing aggregates on their strength. Additionally, it explores the use of local materials, like those sourced from the Ganderbal District of Jammu and Kashmir, to encourage sustainable construction practices. Through an experimental program, this research aims to provide insights into the optimization of concrete mix proportions for improved strength, workability, and eco-friendliness.

Literature Review:

Experimental study on the effect of aggregate content on fracture behavior of concreteM. Harini, G. Shaalini, and G. Dhinakaran (2011)

The study employs a mixed-methods approach, combining quantitative surveys and qualitative interviews.
This design enables a comprehensive understanding of communication practices across various organizational levels.

Evolution characteristics of three-dimensional force chains in a permeable concrete particle system influenced by aggregate sizeZahid Ahmad Chat, Umer Salam, Shahid Bashir (2015)

Different types of aggregates (e.g., limestone vs. granite) can show varying compressive strengths based on their size distribution. This highlights the importance of both size and type in determining performance.
This paper investigated the type of aggregates size. The gradation or distribution of aggregate sizes can also affect strength. Single-graded aggregate sizes tend to improve compressive strength as particle sizes decrease.

Effect of Size and Type of Fine Aggregates on Flowability of MortarM. Harini, G. Shaalini, and G. Dhinakaran (2011)

The specific gravity for river sand was 2.76, whereas crusher dust had a specific gravity of 2.85, suggesting that crusher dust is denser than river sand. The uncompacted void content of the aggregates, which can be influenced by shape and texture, plays an important role. Higher void content usually

leads to a requirement for more cement paste to fill gaps and achieve. Various testing methods are employed to measure this property, with notable methods including the standard flow table test and others based on ASTM standards.

Compressive Strength of Concrete Using Natural Aggregates (Gravel)And Crushed Rock Aggregates-A Comparative Case Study K.Bhavya, Dr. N Sanjeev (2017)

natural aggregates are readily available and economically sourced from local rivers and nallas in the Ganderbal District of Jammu and Kashmir, making them a practical choice for construction projects in the region.he findings encourage the adoption of natural aggregates in concrete production as a standard practice in Kashmir, advocating for eco-friendly construction methods and improved concrete performance

Mechanical Property Test of Polyvinyl Alcohol (PVA) Fiber Reinforced ConcreteErxia Du, ujieYana , Jiao Guo(2017)

After adding fiber with fly ash, compressive strength and rigidity of test piece reduce and with average decrement amplitude 21.27%. Peak growth of compressive strain indicates the growth of toughness. The average increment amplitude is 2.55%, which is about 12 times of normal concrete Fiber concrete material can improve their ductility by using aggregate with conventional size or by reducing fiber content, which provides reference bases for the application of fiber concrete in projects.

Effect of Different Types of Coarse Aggregates on Physical Properties of Mostly Used Grades M20, M25, M30 K.Bhavya, Dr.N Sanjeev (2017)

The compressive strength of concrete is affected by the type of coarse aggregate used. For example, concrete made with 12mm crushed quartzite exhibits the highest compressive strength compared to those made with granite and river gravel 6. Conversely, river gravel shows the least strength development at all ages of curing, indicating lower durability compared to other aggregates suggest that for optimal compressive strength in concrete, quartzite is the preferred choice, followed by granite, while river gravel should be used with caution depending on project requirements 664.

SA-based concrete seismic stress monitoring: The effect of maximum aggregate size Vinodh Kumar Balaji, Chinnakotti Sasidhar (2017)

The maximum size of aggregates plays a crucial role in influencing the performance of smart aggregates in concrete structures.
It affects compressive strength, crack propagation patterns, and the variability of stress monitoring outputs, thereby impacting the overall effectiveness of SAs in practical applications. Further research is essential to fully understand these relationships and optimize the use of smart aggregates in concrete design and monitoring systems.

Effects of binder strength and aggregate size on the compressive strength and void ratio of porous concreteP. Chandrasiri, S. Hatanaka, N. Mishima, Y. Yuasa, and T. Chareerat(2009)

The strength reduction parameter is consistent across different binder strengths and can be used to estimate the relationship between compressive strength and void ratio for specific aggregate sizes. A general equation has been developed to relate compressive strength and void ratio for porous concrete, demonstrating the applicability of these findings in practical scenarios.

Investigating the Effects of Coarse Aggregate Types on The Compressive Strength Of ConcreteAginam, C. H.1, Chidolue, C. A.2, And Nwakire,(2011)

Coarse aggregates should be washed before use to enhance strength. Crushed granite, while potentially more expensive, should be preferred for high-rise buildings and structures requiring high safety factors due to its superior strength. For smaller structures, natural gravels may be more economical, provided they are properly sourced. These findings emphasize the critical role that the type and treatment of coarse aggregates play in the overall performance of concrete.

A Comparison of Five Methods for Expressing Aggregation DataF. W. SCHALLER AND K. R. STOCKINGER2(2015)

Strong correlations were found between single size fractions and other aggregation indices. Using fewer sieves allows for larger sample sizes, increasing accuracy. Simplified methods can lead to more consistent results. the > 2 mm and > 1 mm fractions are preferable for reliable assessments compared to smaller fractions.

Effect of Coarse Aggregate Size on the Compressive Strength and the Flexural Strength of Concrete Beam joseph ode Bayo Ige (2015)

The research investigated the effect of varying coarse aggregate sizes on the compressive and flexural strengths of concrete beams. It was observed that as the coarse aggregate size increased, the flexural strength of the concrete beams decreased while the compressive strength increased. The study concluded that the choice of aggregate size in concrete mix is crucial for achieving desired strength properties and structural integrity.

Properties of Concrete as Influenced by Shape and Texture of Fine AggregateKiran Kumar Poloju(2017)

The experimental program aims to study the influence of aggregates on the strength and workability of concrete. The program focuses on the shape and texture of fine aggregate, including natural sand and stone dust. Preliminary investigations have been conducted on the type of aggregates available in the vicinity and their characteristics. The study also considers the grading of aggregates and the influence of water-cement ratio on concrete strength. The experimental program will analyze the compressive strength, split tensile strength, and workability of different concrete mixes. The objective is to optimize concrete mix proportioning for improved performance .

Comparative Analysis of Concrete Strength Utilizing Quarry-Crushed and Locally Sourced CoarseAggregates Aquib Ansari, Amanullah , Nikhil Madne , Mohd Zaid Sufiyan , Ayesha Siddiqua(2019)

This paper investigates the effects of using unwashed gravel in construction on the compressive strength of concrete.
The study aims to further the knowledge of aggregate choices for construction works and encourage the use of locally sourced gravel.
The materials and methods used in the study are described, including the sampling method and analysis of the aggregates.

Compressive strength of concrete using lateritic sand and quarry dust as fine aggregateGodwin A Akeke(2012)

The study investigated the use of lateritic sand and quarry dust as fine aggregate in concrete.
The density and compressive strength of the concrete were measured, and it was found that the properties compared closely with normal concrete.
The mixture of 25% laterite and 75% quarry dust produced the highest compressive strength.

Study of the influence of aggregate size distribution on mechanical properties of concrete by acoustic emission techniqueKeru Wu, Bing Chen, Wu Yao(2001)

Larger aggregates can reduce the workability of concrete, making it harder to mix and place. Smaller aggregates tend to improve workability due to their increased surface area and ability to fill voids.
The compressive strength of concrete is often enhanced by using specific aggregate sizes. Generally, a well-graded mix of aggregates can lead to better particle interlock, increasing the overall strength. Larger aggregates may improve the durability of concrete by reducing permeability. This is important in environments where moisture and chemicals can lead to degradation.

Influence of aggregate size on compressive strength of pervious concreteFan Yu, Daquan Sun ⇑ , Jue Wang, Minjun Hu(2019)

The aggregate size of around 7 mm is critical for achieving maximum compressive strength in pervious concrete, the specific optimum sizes are 9.5 mm for ordinary Portland cement and 10 mm for fly ash-lime-gypsum binders.
Ongoing research is necessary to further clarify the relationship between aggregate size and compressive strength, considering the influence of pore structure and cementitious paste thickness on overall performance .

Study of the influence of aggregate size distribution on mechanical properties of concrete by acoustic emission techniqueKeru Wu, Bing Chen, Wu Yao(2001)

Large aggregates can reduce the workability of concrete, making it harder to mix and place. Smaller aggregates tend to improve workability due to their increased surface area and ability to fill mix of aggregates can lead to better particle interlock, increasing the overall strength.

The Effect OF Aggregates Size ON Strength AndDeformation OF Concrete.

D. Tsiskreli and A. N. Dzhavakhidze(1970)

While larger aggregates enhance compressive strength and stiffness, they compromise tensile strength and homogeneity, necessitating careful consideration in concrete mix design for specific structural applications Decreases significantly with larger aggregate sizes (30-50% reduction). Improved with larger aggregates, especially at low cement content.

Aggregates Size On Strength And Deformation OF ConcreteD. Tsiskreli and A. N. Dzhavakhidze(1966)

The document discusses the effect of aggregate size on concrete strength, deformation, and other characteristics, emphasizing the importance of aggregate composition in concrete mix design.
The choice of aggregate size impacts concrete workability, density, and strength characteristics. Increasing aggregate size can improve compressive strength but may reduce homogeneity and other properties.

Experimental study on size of aggregates, size and shape of specimens on strength characteristics of pervious concrete T. Chockalingam a,b , C. Vijayaprabha c,* , J. Leon Raj d,e(2023)

The compressive strength of pervious concrete decreases with increasing aggregate size and specimen height.
The strength ratio and strength loss percentages are used to determine the compressive strength of different-sized specimens.
The size effect laws can be used to predict strength characteristics of nonstandard pervious concrete specimens.

Compressive strength of reduced concrete specimens considering dimensional distortion of coarse aggregatesCarlos Felipe de Azevedo a,⇑ , José Maria Franco de Carvalho b , Júlia Castro Mendes a , Arthur Silva Santana Castro a , Rodrigo Rony Barreto a , Ricardo André Fiorotti Peixoto(2020)

The study investigates the compressive strength of small concrete specimens compared to the standard size recommended by codes. It analyzes the dimensional distortion of aggregates and the influence of the wall effect.
The results show that reduced specimens have similar compressive strengths but higher variability. The Wall Effect analysis reveals an increase in mortar content near the border.
The size of aggregates does not significantly affect the results for 40 MPa concrete.
Aggregates smaller than 12.5 mm do not considerably influence the compressive strength.
The findings provide insights into the mechanical behavior of small cylindrical specimens.

A comprehensive investigation into the effect of aging and coarse aggregate size and volume on mechanical properties of self-compacting concreteI.M. Nikbin a,⇑ , M.H.A. Beygi a,1 , M.T. Kazemi b,2 , J. Vaseghi Amiri a,1 , E. Rahmani a,1 , S. Rabbanifar a,1 , M. Eslami c, (2014)

It includes six SCC mixes with three maximum aggregate sizes: 9.5 mm, 12.7 mm, and 19 mm.
These mixes are designed for two strength levels: medium strength (M-series) and high strength (H-series)

THE EFFECT OF AGGREGATE SIZE ON STRENGTH AND DEFORMATION OF CONCRETEG. D. Tsiskreli and A. N. Dzhavakhidze (1970)

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Effect of Aggregate Size Distribution on Concrete Compressive StrengthMd Bashirul Haque Md Ishtiaque Tuhin (2012)

Proper grading and fineness modulus of both fine and coarse aggregates are critical in achieving optimal concrete compressive strength. Fine aggregate is classified based on particles passing through a No. 4 sieve (0.187 inch).Coarse aggregates with different fineness moduli (6.0, 6.5, 7.0, and 7.5) were used in the study. Concrete compressive strength increases with the increase of the fineness modulus of both fine and coarse aggregates.

Conclusion:

The study highlights the significant impact of aggregate size, type, and treatment on the mechanical properties of concrete, particularly its compressive and flexural strengths. The research confirms that smaller, well-graded aggregates generally improve compressive strength, while larger aggregates can enhance flexural strength but reduce workability. Quartzite proved to be the most effective aggregate for achieving high compressive strength, making it ideal for structural applications requiring durability and performance. Conversely, river gravel and unwashed aggregates may compromise concrete quality due to lower strength and workability. The findings also advocate for the use of locally sourced natural aggregates, such as those from the Ganderbal District, to promote sustainable, cost-effective construction practices. Ultimately, a careful balance of aggregate selection and mix proportioning is crucial for optimizing concrete performance in different applications

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