

Review Paper on Properties of Concrete as Partial Replacement of Coarse Aggregate and Sand using Polypropylene Fiber with Foundry Sand

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ABSTRACT

Concrete has better resistance in compression while steel has more resistance in tension. Conventional concrete has limited ductility, low impact and abrasion resistance and little resistance to cracking. A good concrete must possess high strength and low permeability. Hence, alternative Composite materials are gaining popularity because of ductility and strain hardening. To improve the post cracking behavior, short discontinuous and discrete fibers are added to the plain concrete. Waste foundry sand is major disposable item of metal casting industries. Use of waste foundry sand in concrete makes it economical, and also solves the problem of its disposal. Addition of fibers improves the post peak ductility performance, pre-crack tensile strength, fracture strength, toughness, impact resistance, flexural Strength resistance, fatigue performance etc.

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RIGID PAVEMENT

A rigid pavement is constructed from cement concrete or reinforced concrete slabs. Grouted concrete roads are in the category of semi-rigid pavements. The design of rigid pavement is based on providing a structural cement concrete slab of sufficient strength to resists the loads from traffic.

IRC 44: 2008 recommends, minimum M40 grade of concrete (flexural strength 4.5 MPa) for construction of normal concrete pavements.

For rural roads minimum M30 grade of concrete (flexural strength 3.8 MPa) is recommended to be used.

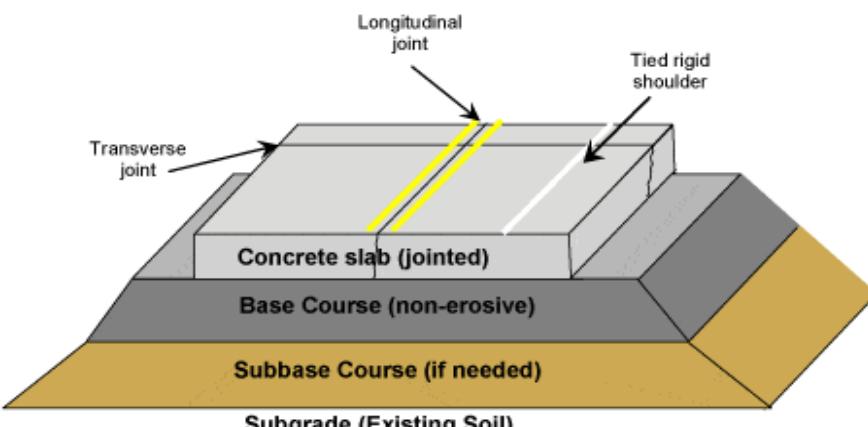


Figure 1.1 Rigid pavement crosssection



Figure 1.2 Rigid pavement construction

LITERATURE REVIEW

➤ **Mehrdad Mohammadian 2022** The carpet waste fibers and waste glass that create a serious environmental problem can be converted into useful products. The use of these waste materials in a cement-based composite can be a promising direction for waste reduction and resources conservation. In this study, several tests carried out to investigate the performance of control mortar using recycled glass and fibers as a fraction of aggregates in a cement-based composite.

➤ **Allan Manalo 2022** Waste administration is an area of critical worldwide concern. The reuse of waste materials, (for example, plastics, glass, wood, and so on) in substantial assembling has been read up for possible expense investment funds, upgrades in quality, and decrease of ecological effect prompting maintainability. This study analyzes the presentation of cement containing reused polyethylene terephthalate (PET) squander in granular structure to supplant the fine total. A progression of substantial examples for Grade 32 substantial blend were given involving PET granules a role as halfway substitution to fine totals in the combination (0%, 10%, 30%, and half substitution by volume of fine total). Significant properties like functionality (droop), thickness, compressive strength, versatile modulus, elasticity, flexural strength, and break mouth opening relocation (CMOD) were assessed along with the microstructural perceptions. The trial results demonstrated that volumetric supplanting of fine totals with 10% reused PET granules emphatically affected the qualities of the substantial. The discoveries further uncovered an improvement in the malleability of cement with reused PET granules content, but the impact was more articulated with the substantial containing 10% PET granules. The exploratory outcomes for

the mechanical properties were thought about against accessible Australian and American plan rules and a solid straight relationship is noticed. Finally, the discoveries of this review on mechanical properties uncovered an ideal execution comparative with those announced in the accessible writing, especially for the substantial with 10% of fine total supplanted by PET granules.

➤ **Anju Mary Elias, 2021** Coconut shell and coir filaments are the normal materials which is bounteously accessible in tropical districts. Squanders produced by modern and horticultural cycles have made removal and the executives issues which present genuine difficulties to endeavors towards ecological preservation. A lot of coconut shells and filaments stay in the climate as waste, so use of these materials for development will be a significant stage to further develop supportability and eco-accommodating development. Notwithstanding that it will assist with delivering light weight and monetarily beneficial materials in development field. A review on the monetary angles was additionally done. The expansion of fly debris assists with expanding the strength and usefulness of cement. The outcomes acquired from above will be contrasted and customary cement of same blend. Catchphrases: coconut shell, coir filaments, compressive strength, electrical resistivity, fly debris, pH, parting elasticity, temperature resistivity, water assimilation.

➤ **Subham Gupta (2019)** One of the constituent of concrete is natural sand or river sand. The issues of environmental degradation and expensive nature of the river sand are increasing day by day. The Global consumption of natural sand or river sand has become more due to excessive use of

concrete so that the demand of river sand is very high and there is shortage of good quality of river sand. These reasons make us to switch on the alternative sources. Many researches has been done yet to replace the river sand. The objective of this research is to an experimental study of concrete using Foundry Sand as a replacement of fine aggregates. So Foundry Sand is replaced with 5%, 10%, 15% and 20% by weight of fine aggregates and mechanical properties such as Compressive strength, Spilt Tensile strength and Flexural strength are investigated. Foundry Sand acts like filler minerals which helps to reduce pores, reduce moisture resistivity. M40 grade of concrete is taken for study. The rheology studies are also made in detail as the fine content of concrete increases, the water demand increases to make it workable. Hence to overcome this problem, 1% of chemical admixture (water reducer) i.e., super plasticizer is used. The compressive strength, flexural strength and split tensile strength increase when fine aggregate was replaced by Foundry Sand at 5, 10, 15, and 20%. The Optimum percentage of replacement is 15%.

- **Sangeetha DM, 2019** Utilization of Fiber Reinforced Concrete (FRC) is one of the approaches to conquer the low elasticity of cement. Both natural and inorganic strands can be made use in the creation of FRC. Then again, the utilization of waste plastic is causing a genuine ecological contamination since the plastic don't weaken. Such waste plastic can be reused as filaments to deliver squander plastic FRC. Further, flyash, microsilica and redmud are another modern waste materials adding to ecological contamination. These waste materials are having cementitious properties and can be involved alongside squander plastic filaments in cement to lessen their hindering impact on mother earth. Hence in this paper an endeavor is made to evaluate the appropriateness of waste plastic FRC for development purposes when various rates of flyash, microsilica and redmud are presented. Different strength properties, for example, Compression, Tension, Flexure and Impact are concentrated alongside usefulness qualities. In light of the got results the modern squanders, for example, flyash, microsilica, redmud and furthermore squander plastic filaments can be utilized in the creation squander plastic fiber built up substantial composite material.
- **Uma Shankar Yaligar 2018** The protected removal of plastic is the most difficult issue for the strong waste administration across the globe.

Concrete is probably the most ideal decision of development material in numerous nations today. This has expanded the quick evaporating of regular assets. It very well may merit testing the utilization of plastic waste in cement to defeat the duel issues of deficiency of natural substance and safe removal of plastic waste. An endeavor has been made to concentrate on the chance of arranging waste plastic as concrete in concrete. In this study squander plastic blend concrete is additionally used to get the upsides of plastic in concrete. A test review was done with substantial tiles to assess mechanical properties of waste plastic blend concrete in with and without the expansion of fiber. Concrete is supplanted with plastic waste at a measurement of 10% to 15% by mass which is the ideal rate without impressive decrease in strength. In this way, it is gathered that substitution of concrete by plastic waste up to 35% can be embraced so removal of utilized plastic should be possible as well as lack of regular total can be overseen successfully. As the volume of waste plastic in substantial builds there was expansion in compressive strength, consequently saw that upto 35% of substitution of waste plastic by concrete in substantial tiles increments compressive strength.

- **Hoe Kwan MahyuddinRamli, 2017** Notwithstanding being presented to chloride and sulfate assaults, marine structures are liable to seismic and affect loads coming about because of waves, affect with strong protests, and water transports. Accordingly, the flexural conduct and effect protection of Fibre-Reinforced Concrete (FRC) in marine condition must be clarified. Nonetheless, such data is barely announced. Along these lines, this examination plans to investigate the impacts of mimicked forceful conditions on flexural quality and effect protection of FRC and to recognize the connection between the two parameters. Three sorts of filaments, specifically, coconut fibre, Barsrap fibre (BF), and soluble base safe glass fibre, were utilized as a part of this investigation. The fibre measurements extended from 0.6% to 2.4% of the cover volume. All blends have consistent water/folio proportion of 0.37 and their compressive qualities were all surpassing 60 MPa. The examples were arranged and presented to three diverse forceful presentation situations, in particular, tropical atmosphere, cyclic air and seawater conditions, and seawater condition for up to 180 days. Results demonstrate that flexural quality and effect protection of FRC have an immediate association with fibre content. Regardless, change in fibre write is more critical

than expanding fibre dose in improving flexural quality yet modification in the two issues would fundamentally affect the effect protection. Rigidity of an individual BF (640 MPa) is significantly higher than the flexural quality of the BFRC composite. Along these lines, disappointment of solid lattice was seen to happen preceding the crack of the fibre which thusly brought about fibre haul out from the solid grid. Among the different FRC analyzed, FRC containing the most elevated BF content (2.4%) exhibited the best flexural quality execution. The flexural quality of the Bar strap FRC was seen to be expanded by 11– 13% in all presentation situations following 180 days. The pre-break vitality ingestions, which were resolved through effect stack test, were found to increment by 60– 63% when contrasted with the control solid, which showed no post-split vitality assimilation. In the interim, the post-break vitality retentions of the 2.4BF were found to go between 3.67 J and 3.71 J for different ecological introduction conditions. Examination of fluctuation (ANOVA) comes about demonstrated that flexural qualities were fundamentally expanded following a half year of presentation to the different forceful condition conditions, particularly in seawater. This could be because of arrangement of salt gems which contributed towards improving the fibre/lattice frictional bond. Notwithstanding, the presentation situations have no noteworthy impact on affect protection execution.

➤ **Su-Jin Lee, 2015** In this investigation, Flexural execution tests were completed for the subsequent half breed fibre-strengthened bond composites. its most extreme load was 30% more noteworthy than the outlined extreme load and 3.5% more prominent than that of a steel fibre-strengthened composite part. The material execution of cement with a half and half blend of fortifying basic nano-engineered and steel filaments was assessed. The best blend was then tried in a precast RC composite part utilizing the most reduced conceivable steel proportion to assess the flexural execution.

OBJECTIVES

Study on Properties of concrete prepared by partial replacement of coarse aggregate using Polypropylene Fiber with foundry sand as partial replacement of sand.

CONCLUSION

In above study, it can be concluded that higher strength and workability characteristics of Using Polypropylene Fiber with foundry sand as partial of

coarse aggregate and fine aggregate for Rigid Pavement.

REFERENCES

- [1] American Society for Testing and Materials, (ASTM). C 192-90a. Standard Method of Making and Curing Concrete Test Specimens in the Laboratory.
- [2] Antoni, Honguchi T. and Saeki N. "Influence of Stress on Chloride Penetration into Fiber Reinforced Concrete", JCI, Vol. 25 (2003), pp. 779-784.
- [3] Baldenebro-Lopez, F. J., Castorena-Gonzalez, J. H., Velazquez-Dimas, J. I., Ledezma-Sillas, J. E., Gómez-Esparza, C. D., Martinez-Sánchez, R., Herrera-Ramirez, J. M. "Influence of continuous plastic fibers reinforcement arrangement in concrete strengthened", IOSR Journal of Engineering (IOSRJEN), Vol. 04(04), PP 15-23, 2014.
- [4] Carnio, M. A., Gomes, A. E. and Lintz, R. C. C., "Fiber reinforced Concrete" Technical Report on Average Residual Strength (ARS), ASTM C 1399-7a.
- [5] Ch. Naga, S. K., Krishna, P. V. V. S. S. R. and Rohini, D. K. "Effect of fiber and aggregate size on mode-I fracture parameters of high strength concrete", Advances in Concrete Construction, 5(6), 613-624, 2017.
- [6] Chunxiang Qian and Piet Stroeven, 2000, 'Fracture Properties of Concrete Reinforced with steel –polypropylene hybrid fibers, Cement and Concrete Composites, 22, 343-351.
- [7] Foti D. "Preliminary analysis of concrete reinforced with waste bottles PET fibers." Construction and Building Materials. pp. 1906-1915, 2011.
- [8] Fraternali et al. "Experimental study of thermo-mechanical properties of recycled PET fiber-reinforced concrete", Composites Structures. pp. 2368-2374, 2011.
- [9] Gencel, Ozel, Brostow and Martinez (2011) 'Mechanical Properties of Self-Compacting Concrete Reinforced with Polypropylene Fibres', Materials Research Innovations 2011 VOL 15 NO.
- [10] GFRC and PFRC", Cement and Concrete Research, Vol. 35 (2005) pp. 1587-1591.
- [11] Hadi, M. N. S., "An Investigation of the Behaviour of Steel and Polypropylene Fibre Reinforced Concrete Slabs," 7th International

Conference. Concrete: Construction's Sustainable Option - Harnessing Fibres for Concrete Construction, Dundee, Scotland, 8-10 July 2008.

[12] Hadj Mostef, A., Merdaci, S., Ouahhabi, H. and Ould Larbi, L. "Concrete with added pozzolana reinforced with metal fibers", Proceedings of the International Symposium: On Composite Materials and Structues, University of Oran, Algeria, November 2011.

[13] Hadj Mostefa, A., Ghernouti, Y., Merdaci, S. and Ouahhabi, H. "Renforcement du béton par desfibres métalliques locaux", Proceedings of the National Symposium: On Local Materials in Construction, University kasdi merbah, Ouargla, Algeria, Novembre 2012.

[14] Suhaendi, S. L., "Residual Strength and Permeability of Hybrid Fiber Reinforced High Strength Concrete Exposed to High Temperature" Part of Ph. D. Thesis.

[15] Suji, D., Natesan, S. C., Murugesan, R., "Experimental study on behaviors of polypropylene fibrous concrete beams" Journal of Zhejiang University SCIENCE A pp 1862-1775.

[16] Vikas,, T and Jagdish,, C. "Study of Mechanical Properties of Concrete Using Bagasse Ash Coated PET Fibres", International Journal of Civil Engineering and Technology (IJCET), 9(7), pp 1215- 1224, 2018.

