International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 04 | April - 2023 Impact Factor: 8.176 ISSN: 2582-3930

Review on Layered Concrete with Fibers

Sandeep P[1], Likhitha M[2], Praveen Y[3], Murali M[4], Santhosh M[5], Vijay kumar B[6], Ramsagar B[7]

[1,2,3,4,5,6] *UG Students, Department of Civil Engineering, Aditya Engineering College, Surampalem, A.P, India*
[7] *Assistant Professor, Department of Civil Engineering ,Aditya Engineering College , Surampalem, A.P, India*

---***---

Abstract: Structural engineers and researchers are being forced to develop suitable concrete ingredient substitutes for the sake of economy, strength, durability, and sustainability by persistent problems of the era, such as rising cement prices, rising pollution, extreme environmental conditions, and advancement in the construction industry. Researchers are being inspired by material amalgamation technologies to create Layered Concrete (LC), a new form of concrete. In this essay, current advancements in the field of layered concrete (LC) are reviewed. It presents a thorough analysis of the literature on LC in the construction industry. The experimental endeavour aims to evaluate the mechanical qualities and characteristics of layered concrete. A typical concrete mix is used in the compression zone of the LC in this investigation, and a concrete mix containing fibres is used in the tension zone. LC is createdmix containing fibres is used in the tension zone. LC is created.

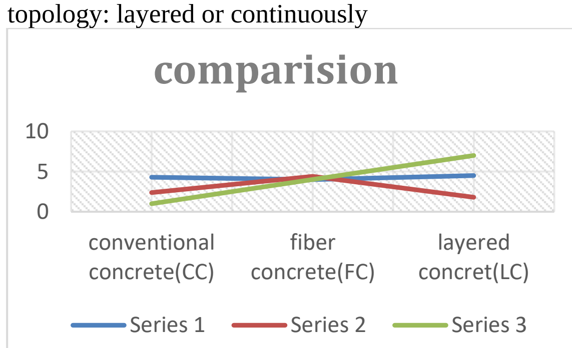
Keywords: cement optimization, Layered concrete, fibers, mix design, two layered specimens.

1.Introduction:

Construction methods are becoming more modernised with an emphasis on high strength, a dense and consistent surface texture, more dependable quality, increased longevity, and quicker construction for economic reasons. The speed of building and the durability of concrete are two factors that have recently caused significant improvement in the concrete business. In layered concrete, different percentages of the constituent materials are gradually added to a multi-phase material in a specified profile, resulting in an irregular microstructure with continuously graded qualities. By altering concrete components (such as fibres, aggregate types, or air gaps) to provide greater flexibility and better efficiency, the functionally graded approach can be utilised to build structural systems more economically. Layered concrete's material characteristics enable optimal .composite material called as layered concrete (LC). LC is developed by varying the microstructure from one material to another material with a specific gradient. worked on structural component mass optimisation to support experimental and analytical findings. The gradation arrangement that served as a digital blueprint for parts was created using numerical design techniques. In a study on the process for creating layered concrete, Aylie Han et al. analysed the behaviour of graded concrete both statistically and empirically. There has been a great deal of analytical work on layered concrete beams by lower and higher grade beam theories, but there hasn't yet been any experimental work to validate these analytical models. Experimental analysis on functionally graded concrete with fly ash and partial cement replacement in the bottom zone and regular concrete in the higher zone was carried out by P. Nithya and M.P. Sureshkumar. Only compressive strength was taken into account.

2. Design concepts and applications

In this paper, non-homogeneous concrete compositions are classified into two main categories based on the desired topology: layered or continuously



Graph-1

Layered concrete is defined here as concrete material with a step-wise spatial variation in composition, i.e. a variable-composition material composed of layers having homogeneous properties .Continuously graded concrete refers to concrete with a continuously variable composition. A spatial variation of material composition can optimize elemental properties to meet certain design requirements. The

main forces up to this point have been a reduction in cement, weight reduction, improved post-fracture behaviour, and increased durability of concrete components. The design goals examined in prior research on layered and continuously graded concrete are covered in the section that follows, along with any potential benefits of functional grading.
casting that is newly-hardened. In the precast business, fresh-on-hardened casting—in which in-situ concrete is poured on top of or within a precast piece to create composite beams or floors—is quite prevalent. In locations susceptible to substantial mechanical pressures or hostile conditions, functional stacking is frequently used to enhance the mechanical characteristics of structural elements. Applying Ultra-High Performance layered Concrete (LC) concrete layers to improve the strength and longevity of bridge decks is an example of a fresh-on hardened casting.

3. Fresh and hardened state design and analysis

Design and analysis problems unique to LC elements are brought on by their inherent topological complexity. The required spatial differences in material composition must be taken into account when designing graded elements in order to properly take into account how concrete will behave in both its fresh and hardened states.brand-new state behaviour Shear stresses may form, causing heavier materials to flow beneath lighter ones when the intended spatial variation in material composition is linked to a variable in material density. Hereinafter referred to as "global instability in the fresh state," this phenomena. Fig. 1 depicts conceptually possible instabilities for horizontally piled concrete. Controlling the behaviour of LC in the fresh state requires an accurate understanding of the link between rheological characteristics, material density, shape, and global instability. Secondly, fresh castingFresh-on-fresh casting techniques for layered concrete are being developed, albeit they are still in the early phases. With the exception of the use of numerous mixes, horizontal layering is comparable to conventional casting techniques.
provides new restrictions on fresh and hardened state compatibility. Although more difficult to execute because the production methods are in the realms of fundamental research, vertical stacking appears promise. Following that, both vertical and horizontal layering are covered.
Horizontal layers Concrete is a yield stress fluid in its fresh form, which means that it behaves solidly for low shear stresses before beginning to flow once a certain threshold shear stress is reached [50–52]. This yield stress, also known as the threshold shear stress, is often low enough for the material.

4. Specimen details

Four different mix combinations were used for the experimental work. One is a regulated concrete mix, while the remaining three have dolomite powder added in three different percentages (20%, 30%, and 40%) in place of cement. While 18 cube, 18 beam, and 18 cylinders were cast with two interface levels in different combinations to pursue the goal of graded concrete, 9 cube, 9 beam, and 9 cylinders are casted for controlled mix. examples of concrete covered in variously thick layers of protection. demonstrates the specimens' determined chloride content at 210 days in an accelerated setting. These findings demonstrate that the protective layer has a preferred thickness. A protective layer that is 10 mm thick provides significant durability protection, but adding more layers of protection does not significantly improve protection. increased such that the interface between the two materials is aligned with the steel bars, a slightly higher degree of corrosion develops. This unexpected result was attributed to differences in electrochemical properties and permeability between the two materials. However, further research is required to fully understand the underlying mechanisms.

5. Conclusion

It is concluded from the literature review and the current study that the layered concrete approach has the potential to save material by up to 40%. Use of high-quality materials only in the regions governing failure will control the post-fracture behaviour of concrete. Use of low-permeability and multiplecracking material in the peripheral regions of reinforced concrete elements will delay the ingress of aggressive substances and subsequently delay steel corrosion. optimisation of the thermal performance of concrete elements by achieving an insulating concrete layer to reduce energy consumption; weight minimization by a spatial variation in density; and minimization of cracking related with hydration heat in mass structures.

Acknowledgement

It is matter of great pleasure for me to publish this paper on “Layered concrete: An Experimental Analysis”. I am thankful to my project guide Asst Prof. B. Ramsagar, HOD Dr. B .Ram Mohan, M.Tech, Ph.D.,& PG-Co-ordinator Dr.S.Govindarajan of Aditya Engineering college, for their constant encouragement, inspiration and able guidance. I take this opportunity to express my deep sense of gratitude towards those, who have helped me in various ways for this work. At the last but not the least, I am thankful to my parents, who had encouraged & inspired me with their blessings.

Volume: 07 Issue: 04 | April - 2023 Impact Factor: 8.176 ISSN: 2582-3930

References:

[1] U.S. Geological Survey. Mineral Commodity Summaries: Cement. Available at: http://minerals.usgs.gov/minerals/pubs/ commodity/cement/. U.S. Geological Survey; 2016.
[2] F. Nogata, H. Takahashi, Intelligent functionally graded material: bamboo, Compos. Eng. 5 (1995) 743–751, https://doi.org/10.1016/0961-9526(95) 00037-N.
[3] K. Ghavami, C. de S. Rodrigues, S. Paciornik, Bamboo: functionally graded composite material, Asian J. Civ. Eng. 4 (2003) 1–10.
[4] S. Amada, S. Untao, Fracture properties of bamboo, Compos. Part B Eng. 32 (2001) 451–459, https://doi.org/10.1016/S1359-8368(01)00022-1.
[5] J.C. Koch, The laws of bone architecture, Am. J. Anat.21(2018)177–298, https://doi.org/10.1002/aja.1000210202.
[6] M. Naebe, K. Shirvanimoghaddam, Functionally graded materials: a review of fabrication and properties, Appl. Mater. Today 5 (2016) 223–245, https://doi. org/10.1016/J.APMT.2016.10.001.
[7] B. Kieback, A. Neubrand, H. R tionally graded materials, Mater. Sci. Eng., iedel, Processing techniques for funcA 362 (2003) 81–106, https://doi.org/ 10.1016/S0921-5093(03)00578-1.
[8] R.M. Mahamood, E.T. Akinlabi, Functionally Graded Materials. Springer; 2017. doi: 10.1007/978-3-319-53756-6.
[9] M. Koizumi, FGM activities in Japan, Compos. Part B Eng. 28 (1997) 1–4, https://doi.org/10.1016/S1359-8368(96)00016-9.
[10] A. Kawasaki, R. Watanabe, Concept and P/M fabrication of functionally gradient materials, Ceram. Int. 23 (1997) 73–83, https://doi.org/10.1016/ 0272-8842(95)00143-3.
[11] A. Kawasaki, R. Watanabe, Finite element analysis of thermal stress of the metal/ceramic multi-layer composites with controlled compositional gradients, J. Japan Inst. Met. 51 (1987) 525–529, https://doi.org/10.2320/ jinstmet1952.51.6_525.
[12] D.K. Jha, T. Kant, R.K. Singh, A critical review of recent research on functionally graded plates, Compos. Struct. 96 (2013) 833–849, https://doi. org/10.1016/J.COMPSTRUCT.2012.09.001.
[13] A.J. Markworth, K.S. Ramesh, W.P. Parks, Modelling studies applied to functionally graded materials, J. Mater. Sci. 30 (1995) 2183–2193, https:// doi.org/10.1007/BF01184560.
[14] S. Suresh, A. Mortensen, Functionally graded metals and metal-ceramic composites: Part 2 Thermomechanical behaviour, Int. Mater. Rev. 42 (1997)85–116, https://doi.org/10.1179/imr.1997.42.3.85.
[15] A. Mortensen, S. Suresh, Functionally graded metals and metal-ceramic composites: Part 1 Processing, Int. Mater. Rev. 40 (1995) 239–265, https:// doi.org/10.1179/imr.1995.40.6.239.