Tuijin Jishu/Journal of Propulsion Technology
ISSN: 1001-4055
Vol. 44 No. 4 (2023)

Experimental Investigation on Strength of RCBeam Using Self-Healing Concrete by Adopting Bubble Technology

N. P. Ramya[1], M. Sangeetha[2], T. Vallarasu[3], C. Charuvarshini[4], K. Abinash[5], Laldinpuii Sailo[6], S. Naren Kumar

Department of civil engineering, Vel High Tech Dr .Rangarajan Dr.Sakunthala Engineering CollegeAvadi

***Abstract*—** This report states that Concrete failures can be a commonproblem if not handled in a timely and appropriate manner, failuresin concrete structures tend to extend their help and definitely need tobe addressed. exorbitant repair. Indeed, while it is conceivable toreduce the degree of cracking with accessible advanced improvements, the remediation of concrete damage has been thesubject of research for many years. Cracks and gaps are a commonproblem in building structures, asphalt roads, and notable landmarks. A quintessential procedure (Bubble Improvement) is considered by many to be a versatile and effective procedure for self-healing. This strategy for repairing cracks in concrete using micro-active calcite precipitates was examined. Bacillus Subtilis, a common soil bacterium that can trigger calcite precipitation. In this study, the microbial concrete was ready for review M30. The mixing level plan is implemented according to the IS code layout. Estimated700x150x150 mm pillars are molded and tested after 28 days .

Keywords— *Flexural Strength, bubble technology, Baacillus subtlius*

I. Introduction

This document is a model of Construction Trends that change from decade to decade. Many years ago, buildings were made of materials such as branches, leaves and earth. Then theconstruction of the structure was developed in many ways using natural materials like clay, stone and wood and finally man-made. It should also be noted that the strength of the material is focused on improving the performance of the structure. Another revolution in building construction is this greater height and span of the structure by developing stronger materials with the right construction method. The bacteria-based concrete self-healing process is much more efficient, as the calcium nutrients. Carbon dioxide is produced by the metabolism of bacter Hollow high-density polyethylene balls replace inefficient concrete at the middle of the slab, reducing dead weight. A method of replacing concrete with recycled logs with less concrete is called "BubbleTechnology".

1.1 Research Objectives

Although to date there have been many studies at the concept of using self-healing beam limited research is applied on self-healing by bubble technology have been performed.

a) To heal cracks by bacterial precipitation.

b) Studying the effect of bacteria and bacilli on increasing endurance.

c) Development of an environmentally friendly technique that avoids the generation of carbon dioxide by using less concrete.

II. Materials Collection

A. CEMENT

Cement is a hardening and setting binder that may bind various materials together. It's a material that's both sticky andcohesive. Cement is made by Ca, Si,Al,Fe.

B. FINE AGGREGATE

Fine aggregate is an important component of concrete; without it, the concrete would not perform as planned. The individual granules of fine aggregate for concrete can be categorised as smooth. The fine aggregate used in concrete, in most cases, must be clean. The final cured concrete will be weakened by impurities in the fine aggregate, such as silt or organic waste.

C. COARSE AGGREGATE

The importance of coarse aggregate in concrete is widely acknowledged. A lower maximum aggregate size gives increased compressive strength in high-strength concrete, whereas aggregate size has no effect on compressive strength in concrete. A lower maximum aggregate size gives increased compressive strength in high-strength concrete, whereasaggregate size has no effect on compressive strength in conventional concrete

D. HPDE BALLS

Hollow high-density polyethylene balls replace inefficient concrete in the middle of the slab, reducing dead weight. The method of replacing concrete with recycled logs with less concrete is called "Bubble Floor Technology".

Fig. 1 HPDE Balls

III Mix Design for M30

Sag value = 100 mm Concrete grade = M30

Cement volume in kg/m^3 = 395 kg/m^3 Volume of water in kg/m^3 = 158 liters/m^3

Volume of fine aggregate in kg/m^3 = 665kg/m^3 Mass of coarse aggregate in kg/m^3 = 11991kg/m^{3}Concrete volume = 1m^3

Ratio of cement water = 0.40Mix ratio = 1: 1.665: 1191

= 1: 1.68: 3.01

= 1: 1.5: 3

4.1 COMPRESSIVE STRENGTH

Table 1 Compressive Strength Of Self Healing Beam

Mixes	7thday in N/Mm2	14thday in N/Mm2	28th Day in N/Mm2	Average in N/Mm^2	% Increasing Strength
C.C	21.9	23.5	22.16	22.5	-
SHC 1	24.6	25.3	25.3	25.1	11.58
SHC 2	27.5	25.41	29.5	27.4	21.98
SHC 3	26.8	24.6	24.1	25.2	11.90

4.2 FLEXURAL STRENGTH RESULTS

Table 2 Flexural Strength of Self Healing Beam

Deflection (mm)	Load (KN)
0	0
0.09	5
0.14	10
0.19	15
0.25	20
0.32	25
0.41	30
0.48	35
0.5	40
0.59	45
0.63	50
0.69	55
0.75	60
0.79	65
0.86	70
0.92	75
1.03	80

IV Testing Results

The cured and casted beam specimens are tested

Table 3 Self Healing Beam With Bubble Technology

Deflection (mm)	Load (KN)
0	0
0.09	5
0.11	10
0.18	15
0.21	20
0.29	25
0.38	30
0.41	35
0.46	40
0.49	45
0.51	50
0.55	55
0.96	80

Table 4 Conventional Beam With Bubble Technology

eflection(mm)	Load (KN)
0.85	6.7
0.95	7.2
1.05	9.1
1.15	9.7
1.25	11.3
1.35	12.9
1.45	14
1.55	15.6
1.65	17.8
1.75	21
1.85	24.5
1.95	20.9

Table 5 conventional beam without bubble technology

eflection(mm)	Load (KN)
0.80	6.7
0.90	7.2
1.04	9.1
1.14	9.7
1.20	11.3
1.30	12.9
1.40	14
1.50	15.6
1.60	17.8
1.70	21
1.80	24.5
1.90	20.9

V Conclusions

In this study, all experimental studies were performed using flexural strength. The bending performance of self-healing beam and conventional beam with bubble technology for greater strength than conventional conventional beam. In the future, we can expand the study of the bubble beam behavior towards beam-column junctions. In terms of strength, further research can be done to improve strength. According to the test performed, thefollowing conclusions are drawn

Table 6 Comparison Of Flexural Strength For All Beam Specimens

Beam Specimens	Flexural Strength in N/mm^2
Self healing beam	4.52 N/mm^{2v}
Self healing beam with bubbletechnology	2.36 N/mm^{2v}
Conventional beam with bubbletechnology	4.32 N/mm^2
Conventional beam	3.36 N/mm^2 N/mm^2

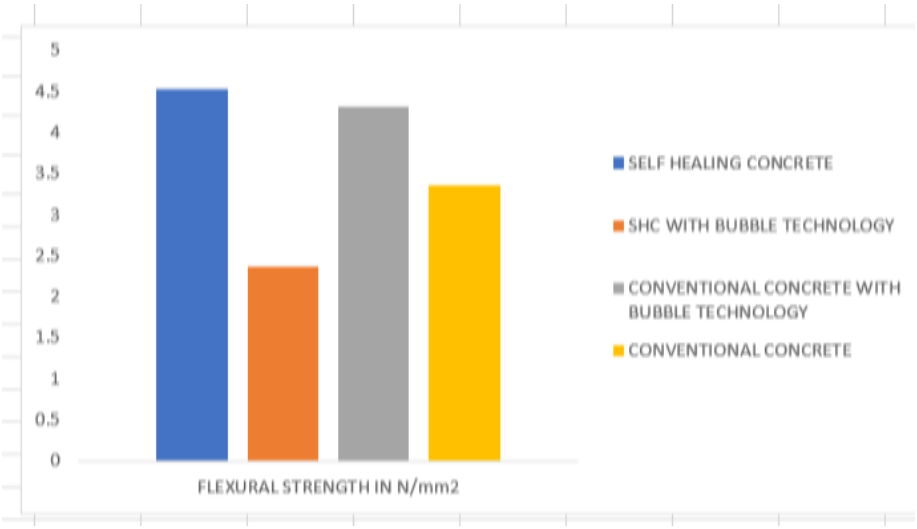

Fig.2 comparison chart of beam specimen

References

[1] Ali Sabah Mahdi, Shatha Dehyaa Mohammed, "Structural Behavior of Bubble Deck Slab under Uniformly Distributed Load" Civil Engineering Journal 5(1):304-319 DOI:10.28991/cej-2021-03091655

[2] Arati Shetkar and Nagesh Hanche, "An experimental study on bubble deck slab system with elliptical balls", Indian Journal of Scientific Research, GALE A454619933, 2015

[3] Chereddy Sonali Sri Durga, Nerella Ruben, Madduru Sri Rama Chand,Chava Venkatesh," Performance studies on rate of self-healing in bio concrete Materials Today: Proceedings DOI:10.1016/j.matpr.2019.09.15, October 2019

[4] Er. Chetan Kumar 1, Er. Shaitan Singh Rawat2, Er. Swati Soni3, "A Review Paper on Self-Healing Concrete", IJARIIE-ISSN(O)-2395- 4396, Vol-6 Issue-1 2020

[5] G.Viswanathan, P.Abirami, S.Atchaya, S.Dharani, M.Kowsalya, "Flexural Behaviour On Fiber Reinforced Bubble Deck Beam With Recycled Aggregate", International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 , p-ISSN: 2395-0072, Mar 2020

[6] H. M. Jonkers, "Bacteria-based self-healing concrete", Academia de la Ingeniería de la provincia de Buenos Aires,ISSN: 2796-7042, MAY 2021

[7] IS 10262- 2009, Indian Standard for Concrete Mix Proportioning – Guidelines, Bureau of Indian Standard,

ManakBhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002.

[8] Islam Riad Ahmed , Elshami Mohamed, M. Yousry Elshikh , "Influence of concentration and proportion prepared bacteria on properties of self-healing concrete in sulfate environment", Innovative Infrastructure Solutions · February 2022 DOI: 10.1007/s41062-021- 00670-2

[9] Klaas van Breugel, "Self-Healing Material Concepts as Solution for Aging Infrastructure", 37th Conference on Our World in Concrete & Structures, Singapore, 29-31 August 2012.

[10] Md. Riad Hossain, Rabeya Sultana, Muhammad Mainuddin Patwary, Noel Khunga, Pankaj Sharma & Sebastian Joya Shaker , "Self-healing concrete for sustainable buildings. A review" Environmental Chemistry Letters (2022)