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Use of Self-Curing concrete in Rigid pavement construction – A review

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Abstract: India is a developing country with a complex climate and topography, and its road network serves as a lifeline for the country's development efforts. However, in other parts of the country, we are unable to find an adequate environment and just enough water to meet our needs, making construction work in arid areas difficult. We tend to use stiff asphalt for desert zones along with its extended lifespan and low cost of maintenance. Concrete is the most significant component for rigid pavement design because of its compressive strength and durability. Concrete's curing should indeed be done carefully if it is to have extra strength and longevity. which has a number of concerns dealing with human neglect, the availability of water in arid locales such as deserts, and a challenging piece of land for transportation. To avoid this problem, we tend to use a combination of Polyethylene glycol, a self-curing agent that prevents water molecules from evaporating from the concrete, thus raising its moisture absorption capability, which aids self-curing concrete with higher workability than normal concrete, during this study.
Keywords: Development work, road construction, self-curing, curing of concrete, evaporation of water, strength and durability

I. INTRODUCTION

The development of every country is dependent on a variety of elements, one of which is construction. However, due to a lack of resources, road construction is either unacceptable or ineffective, as it is incredibly difficult to build a road network in India's dry regions. As a result, laying a road network is challenging due to a lack of water and unfavorable weather conditions. Rigid Pavement is therefore excellent for these types of terrains; however, the one disadvantage of rigid pavement in arid climates is that it requires appropriate curing to get the requisite strength. To acquire the desired strength, it must be cured for at least twenty-eight days. A lack of adequate curing will have a negative impact on the strength and durability of the product. In arid areas, there is still a lot of concrete needed for road construction. Self-curing is a method for maintaining the proper degree of hydration in concrete for an extended period of time. The use of POLYETHYLENE GLYCOL as an additive in ordinary concrete improves hydration and increases concrete strength for proper rigid pavement road network development in desert areas of India.

Figure I
Different Curing Methods Of Concrete

Ways of self-curing:
1) Internal activity (Use of flimsy weight aggregate, Use of admixtures like Polyethylene Glycol)
2) External activity (Water curing, Membrane curing, application of heat)

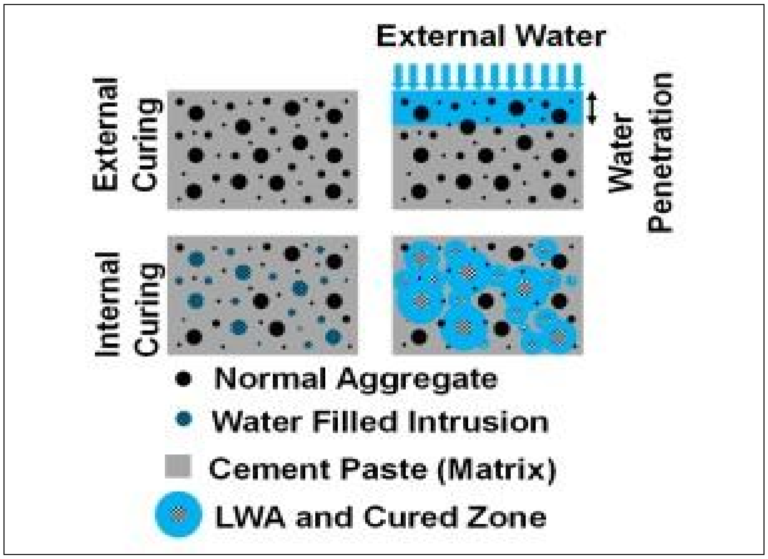

Figure III
Different curing method of concrete where LWA is Light Weight Aggregate

II. LITERATURE REVIEW

Rudra pratap singh et al (2020) In this study, polyethylene glycol was used for improving the properties of concrete at a concentration of 0 to 1.5 percent by weight of cement; the experiment was carried out on M20 and M25 design concrete, and it was shown that polyethylene glycol aids self-healing and improves workability over traditional concrete.

Wen Chen Jau et al (2008) Self-hardening concrete takes water from the air to improve the hydration of the cement in the concrete, according to the manufacturer. When the hydration level of cement is reduced owing to uncured or faulty curing, use a self-curing agent like polyacrylic acid to solve the problem. Polyacrylic acid has a strong ability to absorb water from the environment and give the water needed to cure concrete.

Patel, M. D., & Pitroda, J. R. (2013) According to the findings, PEG400 may help with self-curing by delivering strength comparable to traditional cure. It was also discovered that 1% PEG400 by weight of cement was the best for M20- Concrete in terms of achieving intensity exercise without compromising workability. The introduction of water-soluble polymers in concrete increased the concrete's performance, according to the test results.

Elwakkad, N., & Heiza, K. H. (2019) "Self-hardening" is another term for internal hardening. Any delay in curing will compromise the concrete's strength and durability. To obtain effective curing outcomes, shrinkage reducers and lightweight aggregates such as leca and polyethylene glycol, silica fume, and stone chips are utilized. There is a rise in compressive strength when polyethylene glycol (PEG) and light fine aggregate (LWA) are used.

Rana, A., Sharma, A., & Jassal, K. (2021, November) The primary goal of this research is to evaluate the flexural strength of self-curing concrete. Because flexural strength is a critical requirement for rigid pavement design, the best value for flexural strength is established using an after-treatment agent. The results of this experiment revealed that by optimizing the use of fly ash aggregate and hardening additives, the flexural strength of the road was increased as well, which is sufficient for a rigid road construction according to Indian norms.

Danish, A., Mosaberpanah, M. A., & Salim, M. U. Absorption, swelling, and discharge are all reported features of SAP (Superabsorbent Polymer). SAP's impact on shrinkage (chemical, plastic, oxy-fuel, and drying), rheological (processability, slump, and viscosity), mechanical (compressive, tensile, and flexural strengths), and durability (permeability and freezing). There has been a lot of discussion about resistance) characteristics. Furthermore, this essay presents a critical note on the effective usage of SAP in CC following an in-depth investigation of the foregoing concerns (Cementitious Concrete).

Dahyabhai, P. M., & Jayeshkumar, R. P. (2014) The According to the findings, PEG600 and PEG1500 could assist match the strength of traditional healing. It was also discovered that for M25 grade concrete, 1% PEG600 and PEG1500 by weight of cement was ideal for achieving maximum strength without compromising workability. The inclusion of water soluble polymers in concrete increased the concrete's performance, according to the results of the test.

A. *What is Polyethylene Glycol*

1) Polyethylene Glycol is a condensation product of ethylene and water with the formula H(OCH2CH2)nOH, where "n" is the average number of oxyethylene repetition teams, which ranges from four to about 180.
2) Polyethylene Glycol is also known by the abbreviations PEG1500, PEG600, PEG400, and so on. These abbreviations are followed by a numerical suffix that indicates the typical molecular weights.
3) PEGs have a soluble characteristic, are hypoallergenic, aromatic, neutral, lubricating, non-volatile, and nonirritating, and are used in a wide range of medications.

B. *Benefits of Self-Curing Concrete*

1) It's a different option for growth in desert regions where water is in short supply.
2) Along with its high strength and longevity, it may be adopted to lay Rigid Pavement Road Network in any region.
3) It decreases shrinkage and prevents microcracks inside the concrete structure, increasing concrete strength and decreasing permeability.

C. *Scope and Objectives of Study*

1) *Scope Of Study:* The impact of polyethylene glycol on the strength parameters of self-curing concrete is investigated in this work.
2) *Objective Of Study:* Once you've grasped the significance of self-curing concrete, you'll be able to use it effectively. The purpose of this research is to demonstrate how self-curing concrete can be used to create a rigid pavement road network in India's dry regions.
3) *Test and Result analysis of Self-Curing Concrete (SCC)*

NOTE: In this review we are using standard agents and mixtures like:
Use of M20 grade of concrete having ratio 1:1.5:3 whose compressive strength is 2900 psi. for this test.
Use of POLYETHYLENE GLYCOL (PEG400) as a Self- Curing agent for this test

a) *Workability Test*

Concrete workability is defined as the ease and homogeneity with which a freshly mixed concrete or mortar can be mixed, placed, compacted and finished.
In this study we observed that increase in percentage of self-curing agent in concrete will also increase the value of average slump in (mm).

TABLE III
Police Station Accident Data

Sl.No.	PEG400 in percentage (%)	Average Slump value of M20 concrete mm)
1	0.00	52
2	0.50	61
3	1.00	76

b) *Compressive Strength Test*

Compressive strength test, or a mechanical test that measures the maximum compressive load that a material can withstand before it breaks.
Compressive strength = compressive load / specimen cross-sectional area
In this study we observed that Compressive strength of concrete will slightly increase with increase in time if we are increasing the percentage of self-curing agent into it.

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For Normal Concrete

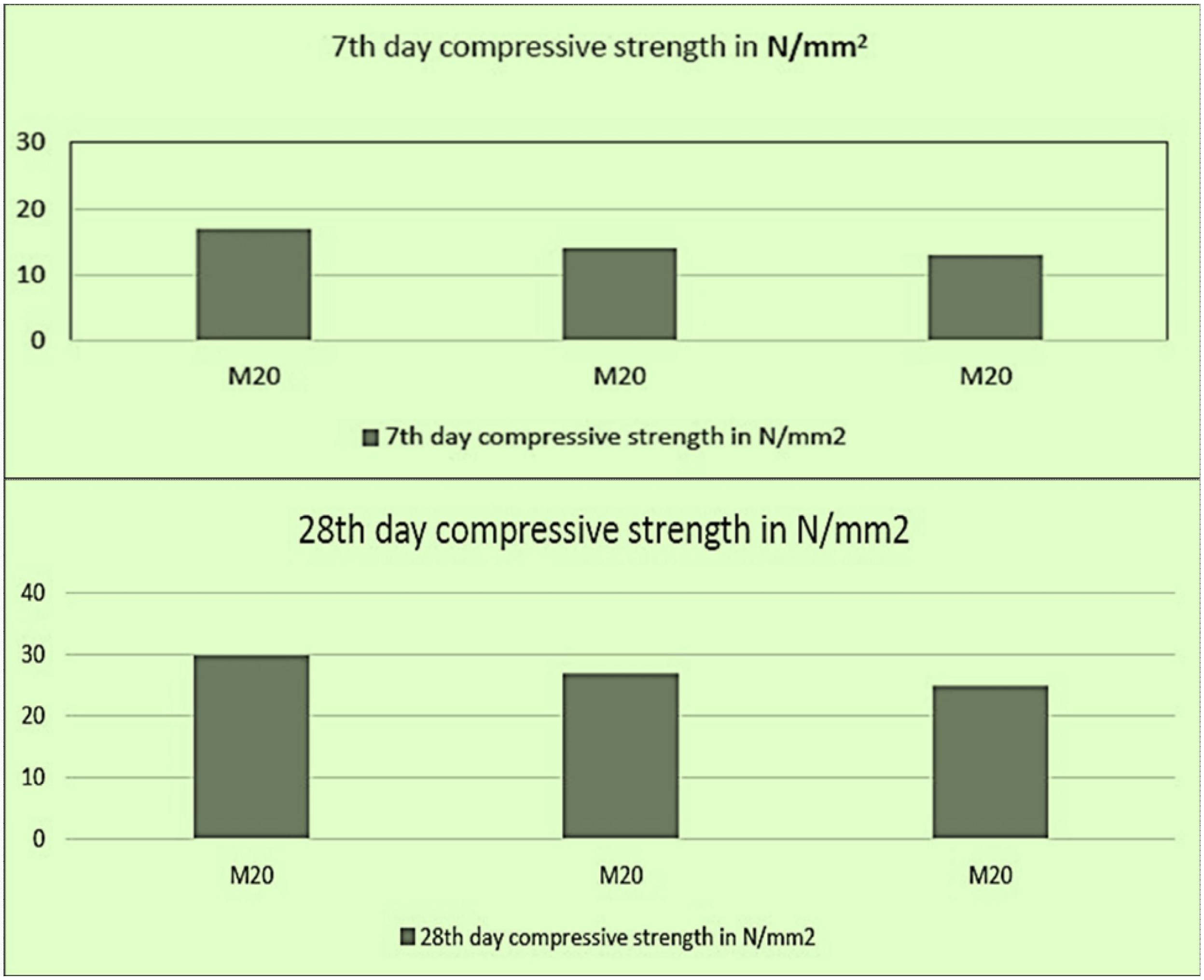
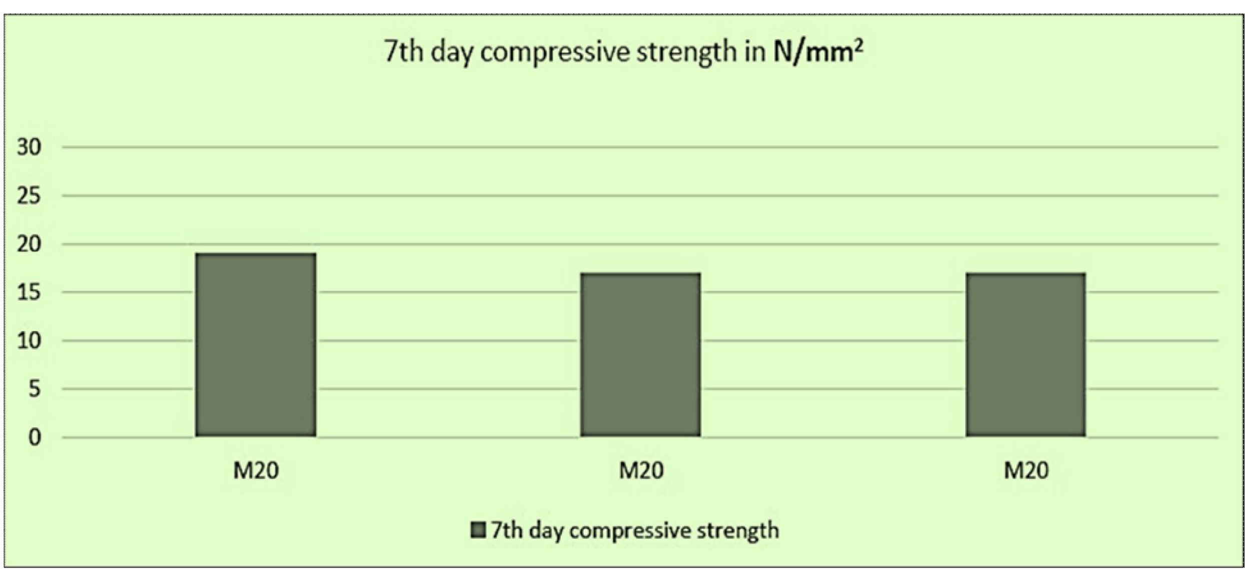


Figure IVII
Compressive Strenth of normal concrete in 7 & 28 days

For Concrete With 1% of PEG400



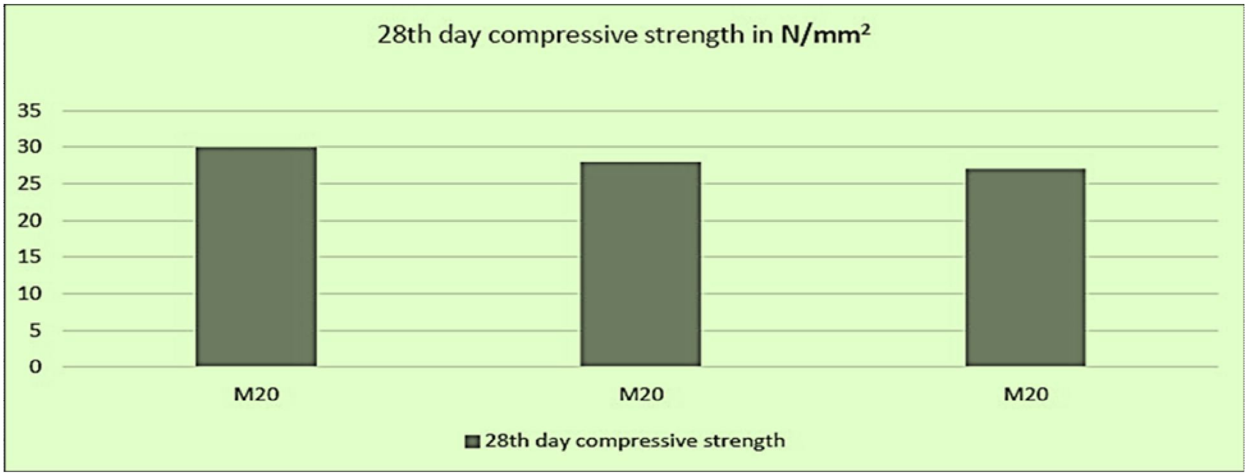


Figure VV
Compressive strenth of concrete with Self-curing agent in 7 & 28 days

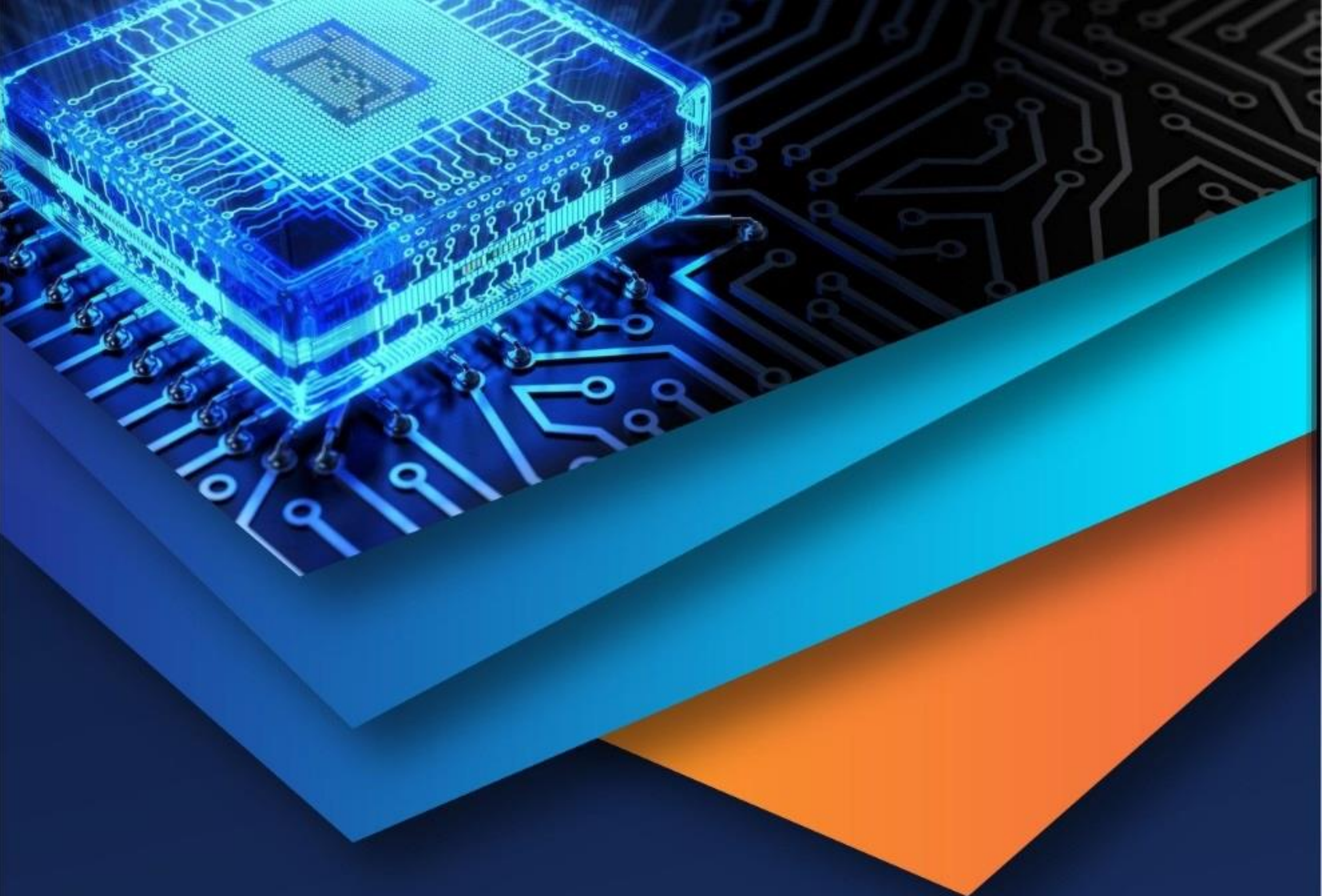
III. CONCLUSIONS

Based on literature review we concluded that:

1) Self-curing concrete (SCC) is a solution to a variety of issues that develop as a result of inadequate curing.
2) In hot desert places where water shortage is a serious issue, SCC provides an alternative to conventional concrete (CC).
3) SCC aims to mitigate early age fracturing caused by a shortage of water.
4) As the amount of polyethylene glycol is increased, the slump value rises.
5) When polyethylene glycol and light fine aggregate are used, the compressive strength increases.
6) SCC requires the use of a self-curing agent

REFERENCES

[1] Bentz, D. P., & Bentz, D. P. (2002). Influence of curing conditions on water loss and hydration in cement pastes with and without fly ash substitution (p. 15). US Department of Commerce, National Institute of Standards and Technology.
[2] Bentz, D. P., & Snyder, K. A. (1999). Protected paste volume in concrete: Extension to internal curing using saturated lightweight fine aggregate. Cement and concrete research, 29(11), 1863-1867.
[3] Hoogeveen, D. C. T. (2005). Internally-cured high performance concrete under restrained shrinkage and creep. CONCREEP, 7, 12-14.
[4] Dhir, R. K., Hewlett, P. C., & Dyer, T. D. (1998). Mechanisms of water retention in cement pastes containing a self-curing agent. Magazine of Concrete Research, 50(1), 85-90.
[5] Geiker, M. R., Bentz, D. P., & Jensen, O. M. (2004). Mitigating autogenous shrinkage by internal curing. ACI Special Publications, 143-154.
[6] Hammer, T. A., Bjontegaard, O., & Sellevold, E. J. (2004). INTERNAL CURING-ROLE OF ABSORBED WATER IN AGGREGATE. IN: HIGH-PERFORMANCE STRUCTURAL LIGHTWEIGHT CONCRETE. In American Concrete Institute Fall ConventionAmerican Concrete Institute (ACI)
[7] Hoff, G. C. (2002). The use of lightweight fines for the internal curing of concrete, prepared for Northeast Solite Corporation. Hoff Consulting LLC, RILEM, TC-196 ICC, raport wewnętrzny.
[8] Kumar, M. J., Srikanth, M., & Rao, K. J. (2012). Strength characteristics of self-curing concrete. Nature, 20, M40.
[9] Lura, P. (2003). Autogenous deformation and internal curing of concrete
[10] Kumar, M. J., Srikanth, M., & Rao, K. J. (2012). Strength characteristics of self-curing concrete. Nature, 20, M40.
[11] Dahyabhai, P. M., & Jayeshkumar, R. P. (2014). Introducing the self-curing concrete in construction industry. J. of IERT, 3(3).
[12] SU, K. (2011). SELF COMPACTED/SELF CURING/KILN ASH CONCRETE. International Journal on Design and Manufacturing Technologies, 5(1).
[13] Selvamony, C., Ravikumar, M. S., Kannan, S. U., & Gnanappa, S. B. (2010). Investigations on self-compacted self-curing concrete using limestone powder and clinkers. ARPN J. Eng. Appl. Sci, 5(3), 1-6.
[14] SU, K. (2011). SELF COMPACTED/SELF CURING/KILN ASH CONCRETE. International Journal on Design and Manufacturing Technologies, 5(1).
[15] Ravikumar, M. S., Selvamony, C., Kannan, S. U., & Basil Gnanappa, S. (2009). Behaviour of Self Compacted Self Curing Kiln Ash Concrete with Various Admixtures. ARPN Journal of Engineering and Applied Sciences, 4(8), 25-30.



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