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Study on Automated Curing System for Mass Concreting Work

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Abstract - At the point when new cement is poured amid the development of expansive homogeneous structures, the warmth created because of hydration of concrete present is considered. This warmth produced is non-uniform in nature and very relies upon creation of concrete. Volume change happen because of expanding temperature at early period of cement. Warm slopes are delivered when the warmth created because of hydration response of bond is scattered through the solid to the encompassing condition, the most reduced temperature happens at the uncovered surface and the most astounding temperature at the inside piece of the solid. Since the high temperature inside needs to extend it makes pliable worries at the surface of the solid. Since the elasticity of cement isn't completely built up these malleable burdens may outperform the early age rigidity of cement and can deliver breaks.

Keywords - Mechanized curing, solid, warm breaks, warm protection compressive quality.

I. INTRODUCTION

During the construction of large structurees such as dams, piers of bridges, large foundation etc. The amount of heat is always considered that will be generated and the resulting volume change occurring due to change in temperature it. Volume changes occur due to varying temperature in the concrete structures which increase rapidly in the initial stages due to hydration of cement and decreases in the later stages as the reaction ceases. Per unit distance temperature variation between two points in a structure is called thermal gradient. These are produced when the heat being generated due to hydration reaction, and it gets dissipated to the surrounding environment. The temperature at the surface of the concrete is lower than the temperature at the core of the concrete. This lower temperature at the surface results in contraction of the exposed surface of the concrete. Since the interior concrete is more mature in comparison to the surface it restricts the contraction which creates tensile stress on the surface. The tensile strength of this early age concrete is not fully developed, if the tensile stresses developed due to temperature gradient are more than the undeveloped tensile strength of the concrete, cracking.

- Automated curing system composed of mainly three parts- a data logger which monitors temperature changes, Main and subsidiary water tank for curing water, and a water heating apparatus and conduits to supply warm curing water to the system.
- This system measures centers temperature and surface temperature of concrete structure using thermal sensors embedded before concrete placement.
- This system minimizes the no. of thermal cracks effectively without any structural damage.

II. LITERATURE SURVEY

S. NO	AUTHORS	TITLE	JOURNAL & YEAR	RESEARCH WORK
1.	Han, C.G, oh, S. G. Shin	The insulating curing method of cold weather concreting. (JKCI-2006)	JKCI-2006	Insulating curing is a essential process in concrete structure which focuses on monitoring the moisture and temperature level in a concrete structure.
2.	Ung-Kyun Lee et. al	Mass concrete curing management based on Ubiquitons computing. (CACIE-2006)	CACIE-2006	The productivity and efficiency of projects can be improved by adopting information technology in construction industry.
7.	Ha. J.H. Jung	Development of automated curing system for mass concrete.	ISARC-2013	Automated curing system reduced the chance of thermal crack occurrence and

		(ISARC-2013		improved quality of the concrete structure as well.
8.	Ju-hyung. Ha et. al	Development of automated curing system for mass concrete. (JKCI-2014)	JKCI-2014	New Automated curing system reduced the chance of thermal crack occurrence.
9.	Jn-hyung Ha et.al	A study on the thermal crack control of large turbine foundation using automated curing system (ISARC-2014)	ISARC 2014	New Automated curing system for mass concrete has been developed to improve the quality of concrete structure and save construction time and cost.

III. PROBLEM IDENTIFICATION

- The thermal crack occurrence from hydration heat is one of the most importance factors that significantly affect structural quality and construction period in mass concrete.
- In case of mass concrete there is a risk of cracking due to internal and external restraint caused by hydration heat.

OBJECTIVE

To Study the effect of automated curing in mass concrete structures for the prevention of thermal cracks and comparing it with normal curing method.

IV. METHODOLOGY

AUTOMATED CURING SYSTEM

Outline of Automated Curing System

Automated curing system composed of mainly three parts; a data logger which monitors temperature changes, main and subsidiary water tanks for curing water, and a water heating apparatus and conduits to supply warm curing water to the system (Figure 1). The system measures center temperature and surface temperature of concrete structure using thermal sensors embedded before concrete placement. When the temperature gap between center and surface exceeds the criterion for crack control (generally 20 □), heated water is supplied automatically on the surface of structure to reduce the temperature gap. This automatic water circulation system minimizes the number of thermal cracks effectively without any structural damage .

V. EXPERIMENTAL RESULTS

Thermal Cracking

Temperature difference within a concrete structure may be caused by portions of the structure losing heat of hydration at different rates or by the weather conditions cooling or heating one portion of the structure to a different degree or at a different rate than another portion of the structure.These temperature differences result in differential volume change, leading to cracks. This is normally associated with mass concrete including large and thicker sections of column, piers, beams, footings and slabs. Temperature differential due to changes in the ambient temperature can affect any structure.

Thermal cracks caused by excessive temperature differentials in mass concrete appear as random pattern cracking on the surface of the member. Checkerboard or patchwork cracking due to thermal effects will usually appear within a few days after stripping the framework. Temperature related cracks in pavement and slab look very similar to drying shrinkage cracks. They usually occur perpendicular to the longest axis of the concrete. They may become apparent any time after the concrete is placed, but usually occur within the first year or summer – winter cycle. Table shows thermal cracking observation of mass concreting.

Table 1 shows thermal craking

Curing Days	Observation	
	Normal Curing	**Automated Curing System**
7 Days	One Minor Crack Observed	No Cracks Observed
14 Days	Two Crack Observed (One Broad and One Minor)	No Cracks Observed
28 Days	Five Cracks (four Broad and two Minor)	No Cracks Observed

VI. CONCLUSION

Automated curing also reduce thermal cracking in mass concrete. The widely accepted limiting temperature differential of 20°C that is likely to cause thermal cracking may not be valid in the tropics for mass concrete structures. Therefore, it will become very helpful method to reduce thermal cracking of massive and important concrete structures.

VII. SCOPE OF FUTURE WORK

- However, further research work is still necessary in order to have a more in-depth understanding of the automated curing system.

- How ever in future the possibility of using certain chemicals instead of water to control the temperature difference at center and surface of mass concrete.

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