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A case study on MinimizingHigh Temperature Effect of Concrete

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ABSTRACT:
Concrete is a construction materials which is widely used in building and infrastructure around the world. As concrete is a building material it possesses high thermal properties, so the study of concrete is more focus of the physical and mechanical properties rather than thermal properties. Mechanical properties of concrete decrease when subjected to high temperature. Thermal properties are mainly determined by thermal conductivity, specific heat, thermal heat, mass loss. Thermal Conductivity is a crucial factor to measure the ability of material to transfer heat. Heats from the ambience which transferred the building will cause discomfort to the users. The objectives of this study are Evaluate the effect of W/C Ratio on concrete at elevated temperature,the effect of Sand Aggregate Ratio on concrete and also the effect of Fly Ash on concrete.Hot weather can decrease the workability and finish ability that can reduce long term strength. This occurs is because temperature can influence the reaction rate of cement and water. The higher the temperature, the higher the rate of reaction and vice-versa.

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I. INTRODUCTION:

Now-a -day's high heat generation on roof of the high rise building in the summer season is a major problem.Energy consumption is increased on daily basis due to constant global population growth and increase of many activities: construction of residential and non-residential buildings equipped with growing number of devices that consume more energy (heating, cooling and household appliances), manufacturing and commissioning of the growing number of road vehicles, development of production in industry and the like. Production of energy is a key sector of a county's economy, and growing demand for energy is an important factor in economic development.

According to Cioni et al. 2001; during exposure to high temperatures such as during fire event, the mechanical properties of concrete (strength, elastic modulus and volumetric stability) are significantly reduced. When a concrete structure is subjected to extreme temperatures, it may fail in many of different ways.

According to S.H. Chowdhury; High strength concrete (HSC) is a material often used in the construction of high rise buildings. In case of unexpected fire, buildingelements such as columns, slabs and walls will be subjected to extreme temperatures. In order to assess the performance of high-rise concrete members to such exposure, it is important to understand the changes in the concrete properties due to extreme temperature.

According to Knaak et al. 2010, Influence thestrength loss is the aggregate type and the strength of the concrete at room temperature. HSC is much more likely than NSC to fail through spalling at very high temperatures.

Concrete generally provides the best fire resistance properties of any building material [2]. This is due to its low thermal conductivity, high heat capacity and slower strength degradation with temperature. This slow rate of heat transfer and strength loss enables concrete to protect itself from fire damage. The behavior of a concrete structural member exposed to fire is dependent on thermal, mechanical and deformation properties of concrete. These properties vary as a function of temperature and depend on the composition characteristics of concrete.

Causes of temperature on Concrete:

In the modern era of contractions the engineer should design the structure with all important features, basically multi-storied buildings including these factors (seismic force, wind force, fire resistance etc.).The behavior of concrete at high temperatures is influenced by several factors including the rate of temperature rise and the aggregate type and stability.High temperatures also affect the compressive strength of concrete.The cement paste begins to dehydrate which gradually weakens the paste and paste-aggregate bond. . High temperatures near the center of large placements also cause that zone to expand while cooler concrete contracts. Thermal cracking can become a serious problem if the temperature disparity becomes too great.

Possible measure to reduce Concrete Temperature:

Hot weather can decrease the workability and finish ability that can reduce long term strength.The higher the temperature, the higher the rate of reaction and vice-versa.Reducing cement content can minimize the heat-generating capacity of the mix. Using cementitious materials, such as fly ash, natural pozzolans, to intensify Portland cement can reduce the temperature rise in concrete while meeting strength and durability requirements.

1. Evaporative cooling: Reducing the aggregate temperature provides the greatest reduction in concrete temperature.
2. Cold Water: Cold water aggregate cooling often is the least expensive way to reduce concrete temperature, especially if the water comes from a naturally occurring source such as a creek fed by melted snow.
3. Mix Quality: There are some fears that concrete slump and strength, and thereforeconcrete quality, will suffer by adding cool water because producers think it causes water content to vary.
4. Cement Consideration: Cement is a source of heat that builds during curing.Reducing the cement content can reduce the amount of heat produced.To reduce cement content, increasethe maximum size of aggregate, usepozzolans, or add water-reducingadmixtures.Adding fly ash to concrete can reduce cement content.Concrete with fly ash gains strength less quickly.

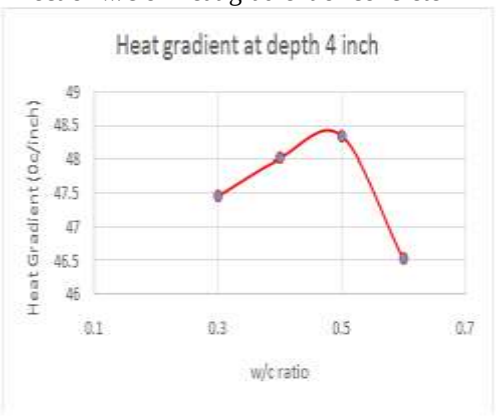
Materials:

Equipment:

Experimental Steps:

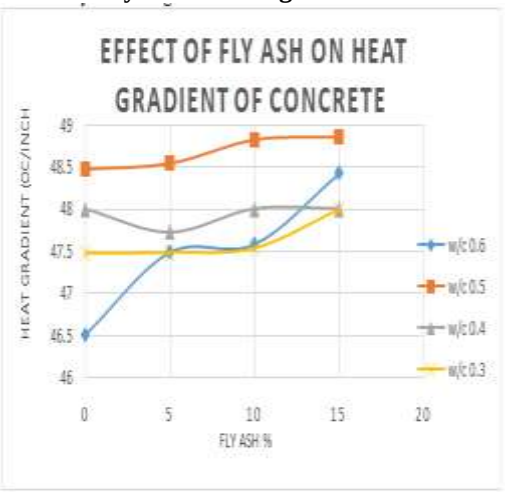
II. RESULTS:

1. Effect of w/c on heat gradient of concrete



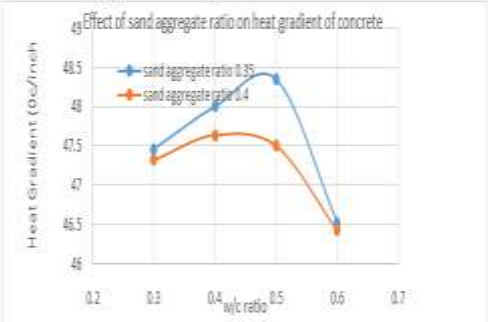
This figure illustrates that 50% w/c ratio gives the highest heat gradient.

2. Effect of fly ash on heat gradient of concrete



This graph shows that increases the of fly ash, increases the heat gradient

3. Effect of sand aggregate ratio on heat gradient of concrete



This graph shows that increases sand aggregate, decreases the heat gradient.

III. CONCLUSION:

study was carried out to know the effect of temperature on concrete and also discussed how to reduce the high temperature on concrete. From graphical results it was clear that heat gradient was dependent on w/c ratio. It also showed that by increasing sand aggregate ratio decrease the heat gradient and also observed that, heat gradient increased by increasing percentage of fly ash.

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