

A Study on the Effect of Different Climate Conditions on Time of Balance of Bleeding and Evaporation in Plastic Shrinkage Cracking of Concrete Pavements

Authors : Hasan Ziari, Hassan Fazaeli, Seyed Javad Vaziri Kang Olyaei, Asma Sadat Dabiri

Abstract : The presence of cracks in concrete pavements is a place for the ingress of corrosive substances, acids, oils, and water into the pavement and reduces its long-term durability and level of service. One of the causes of early cracks in concrete pavements is the plastic shrinkage. This shrinkage occurs due to the formation of negative capillary pressures after the equilibrium of the bleeding and evaporation rates at the pavement surface. These cracks form if the tensile stresses caused by the restrained shrinkage exceed the tensile strength of the concrete. Different climate conditions change the rate of evaporation and thus change the balance time of the bleeding and evaporation, which changes the severity of cracking in concrete. The present study examined the relationship between the balance time of bleeding and evaporation and the area of cracking in the concrete slabs using the standard method ASTM C1579 in 27 different environmental conditions by using continuous video recording and digital image analyzing. The results showed that as the evaporation rate increased and the balance time decreased, the crack severity significantly increased so that by reducing the balance time from the maximum value to its minimum value, the cracking area increased more than four times. It was also observed that the cracking area-balance time curve could be interpreted in three sections. An examination of these three parts showed that the combination of climate conditions has a significant effect on increasing or decreasing these two variables. The criticality of a single factor cannot cause the critical conditions of plastic cracking. By combining two mild environmental factors with a severe climate factor (in terms of surface evaporation rate), a considerable reduction in balance time and a sharp increase in cracking severity can be prevented. The results of this study showed that balance time could be an essential factor in controlling and predicting plastic shrinkage cracking in concrete pavements. It is necessary to control this factor in the case of constructing concrete pavements in different climate conditions.

Keywords : bleeding and cracking severity, concrete pavements, climate conditions, plastic shrinkage

Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development

Conference Location : Chicago, United States

Conference Dates : December 12-13, 2020