ENVIRONMENTAL EFFECTS ON SUBSURFACE DEFECT DETECTION IN CONCRETE STRUCTURES USING INFRARED THERMOGRAPHY

Naveen Bolleni

Dr. Glenn Washer, Thesis Supervisor

ABSTRACT

Deterioration of concrete due to corrosion of embedded steel reinforcing bars and prestressing strands represent a significant challenge for inspection and maintenance engineers. Cracking, delaminations and spalling that can occur as a result of corrosion of embedded reinforcing steel accelerate bridge deterioration and lead to pot holes and even punch-through of concrete bridge decks. The typical method for detecting delaminations is hammer sounding, which requires hands-on access to the material under inspection. Specialized equipment and lane closures are frequently necessary to achieve the required access. The application of infrared thermography to detect subsurface damage in concrete has the potential to image delaminations from a distance, such that direct access to the surface of the concrete is not required. Thermographic imaging relies on certain environmental conditions to create thermal gradients in the concrete such that subsurface features can be detected. This thesis presents the results of an investigation to determine necessary environmental conditions for the detection of subsurface damage in concrete. To evaluate environmental effects, a large concrete test block has been constructed. Embedded targets in the test block were used to model delaminations in concrete. Environmental factors including wind speed, relative humidity, solar loading and variations in the ambient temperature have been measured by a weather station located on-site with the block. The effects of these environmental factors have been examined to determine their impact on the detectability of the subsurface targets. Characteristics of optimum inspection conditions for utilizing infrared thermography in the field are discussed.