ABSTRACT

Miller, Albert Edward. M.S.C.E., Purdue University, August 2014. Using a Centrifuge for Quality Control of Pre-Wetted Lightweight Aggregate in Internally Cured Concrete. Major Professor: Jason Weiss.

Early age shrinkage of cementitious systems can result in an increased potential for cracking which can lead to a reduction in service life. Early age shrinkage cracking can be particularly problematic for high strength concretes, which are often specified due to their high strength and low permeability. However, these high strength concretes frequently exhibit a reduction in the internal relative humidity (RH) due to the hydration reaction (chemical shrinkage) and self-desiccation which results in a bulk shrinkage, termed autogenous shrinkage, which is substantial at early ages. Due to the low permeability of these concretes, standard external curing is not always efficient in addressing this reduction in internal RH since the penetration of water can be limited. Internal curing has been developed to reduce autogenous shrinkage. Internally cured mixtures use internal reservoirs filled with fluid (generally water) that release this fluid at appropriate times to counteract the effects of self-desiccation thereby maintaining a high internal RH. Internally cured concrete is frequently produced in North America using pre-wetted lightweight aggregate. One important aspect associated with preparing quality internally cured concrete is being able to determine the absorbed moisture and surface moisture associated with the lightweight aggregate which enables aggregate moisture corrections to be made for the concrete mixture. This thesis represents work performed to develop a new method using a centrifuge to determining the moisture state of pre-wetted fine lightweight aggregate. The method is then applied to a series of worksheets that was developed to assist field technicians when performing

the tests and applying the results to a mixture design. Additionally, research was performed on superabsorbent polymers to assess their ability to be used as an internal curing reservoir.