# ABSTRACT

Di Bella, Carmelo. M.S., Purdue University, August 2012. Chloride Transport and Shrinkage of Plain and Internally Cured Concrete. Major Professor: Jason Weiss.

Concrete bridge decks are susceptible to premature deterioration which may be caused by cracking of the concrete and corrosion of reinforcing. While engineers strive to design bridge decks to have high performance it has become evident that mixtures that may lead to high strength and low transport properties (i.e., so called high performance concrete) may also have a potential to exhibit increased cracking. Recently there has been an interest in developing mixtures that also strive to minimize the potential for cracking while providing a dense microstructure that reduces the potential for chloride ingress.

Over the last fifteen years there has been growing interest in exploring the use of internally cured concrete since it minimizes early age volume change and corresponding cracking. While the original intention of using internal curing was to reduce autogenous shrinkage, it has been observed that the internally cured concretes have additional benefits. For example previous research has shown that internally cured concrete has lower water absorption than comparable conventional (plain concrete mixtures).

This thesis examines chloride transport and shrinkage of plain and internally cured concrete bridge decks that were cast in the state of Indiana (Monroe Co. near Bloomington) and in the state of New York (Tonawanda and Lisle) in between August and November 2010. In Bloomington, Indiana, two bridge decks were cast in close proximity by the same concrete producer and the same construction crew using the same materials. The first bridge deck used a conventional bridge deck concrete mixture while the second was cast using an internally cured concrete mixture. In the state of New York, in the

cities of Lisle and Tonawanda, two different bridge deck mixtures were commercially prepared using high strength internally cured concrete mixtures at each location.

Volume change properties and chloride transport performances were evaluated using a series of experimental techniques. The results indicate that internally cured concretes demonstrate superior performance to plain concrete. A reduction in volume change is observed for internally cured concrete. In addition, a reduced chloride transport rate in internally cured concrete is observed which can result in structures with improved durability.