SYNOPSIS OF THE PROBLEM BEING RESEARCHED

Durability of cast-in-place concrete bridge decks represents a formidable challenge in the construction and maintenance of highway bridges and a large consideration in each year's maintenance and repair budget. Although construction and design techniques play major roles in the durability of concrete bridge decks, the hardened material properties of the concrete used for their construction play a major role as well. In particular, the permeability of the concrete, or simply its ability to resist penetration of water and other deleterious substances, plays a major role in the deck's ability to resist degradation from freezing and thawing and corrosion of reinforcing steel. Several methods have historically been used throughout the Tennessee inventory to improve the "permeability" of the deck system, or to at least slow the ability of these deleterious substances to penetrate the deck and or reach the level of the reinforcing steel. These include the use of asphalt overlays (protection and ride quality), membranes, additional concrete cover, polymer concrete overlays, and epoxy overlays. While these methods work well, they can generally be considered expensive and serve as a visual hindrance when routine safety inspections of the deck are completed. An additional avenue to reduce the permeability of the bridge deck, and ultimately improve the durability of the deck, is to reduce the permeability of the base concrete used to construct the deck. While the typical Class D concrete that is used for bridge deck construction (new or replacement) is high quality, significant improvement is possible when considering permeability. While several options are available to improve the permeability of a particular concrete mix, it is important to find avenues that are easy for a typical producer to implement, produce concrete that is efficient for the contractor to place, finish, and cure, and are economically efficient while maintaining high quality hardened properties. One such method is to replace a portion of the Portland cement in a typical Class D mix with high volumes of one or more supplementary cementitious materials (SCM). In previous research, this type of replacement has been found to profoundly improve the permeability of a Class D concrete mix, while not having significant negative effects on other hardened properties such as compressive strength and modulus of elasticity. These mixes (3) have been formulated, mixed, and tested in laboratory conditions with great success. The next step in improvement of bridge deck permeability/durability is to move from laboratory mixing and testing to full scale implementation. This research study seeks to select three construction projects (new or replacement decks – low volume roads and rural locations) where each of the three SCM mixes can be used for construction of the deck so that full scale testing and evaluation can be accomplished over an extended time period. These projects will remain unchanged from their original design with the exception of the concrete mix design used for the deck. Several main objectives will be accomplished through this study including development/production of high SCM bridge deck mixes at typical ready mix plants, identification of any placement issues when using such mixes, and quantification of inplace permeability of plant produced concrete exposed to traffic loading and environmental conditions. Improved understanding and successful implementation of high volume SCM low permeability mix designs such as these may lead to bridge decks with increased durability, lower repair demands, increased service lives, and overall reduced cost.