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VALUE OF IMPLEMENTATION

TxDOT Project 5-6656-01, Verification of ASR Resistance Property of the Commonly used Concrete Mix Designs by the Precast Industries in Texas

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Benefit Identification

The Value of Implementation (VoI) analysis is determined at the end of this project to identify appropriate qualitative and economic benefits. Table 1 summarizes the benefit areas determined in this project, followed by a brief discussion for each selected benefit.

Table 1: Qualitative and Economic Benefits

Selected	Functional Area	QUAL	ECON	Both	TxDOT	State	Both
	Level of knowledge						
x	Management and Policy	x			x		
	Quality of Life						
	Customer Satisfaction						
	Environmental Sustainability						
x	Increased Service Life		x		x		
x	System Reliability and Sustainability		x		x		
	Improved Productivity and Work Efficiency						
	Expedited Project Delivery						

	Reduced Construction, Operation, and Maintenance Cost						
x	Locally Available Materials and Optimization			x			x
	Infrastructure Condition						
x	Engineering Design Improvement			x			x
	Safety						

Management and Policy

Policies for determining supplementary cementitious materials (SCMs) [e.g., fly ash] replacement percentage to prevent ASR in different applications could change based on the aggregate reactivity, aggregate threshold alkalinity, and characteristics of SCMs. This project provides technologies of developing a good ASR-resistant mix design and promote overall good service life of precast concrete.

Increased Service Life

This project provides an effective way of validating ASR mix design. This will ensure valuable resource conservation and avoid paying for premium ASR protection when only minor protection is needed. The applied approach facilitates formulating ASR resistance mixes, which ensure long lasting durable concrete.

System Reliability and Sustainability

In 2013, around 92% of new bridges in Texas were built with precast concrete superstructures. Recently, TxDOT is adopting and implementing precast girder sections for extended span lengths of bridges as well. In order to prevent the ASR distresses and maintain the bridges in a good condition, TxDOT needs to validate the mix design by incorporating the design options 1 through 5. In reality, replacement of 20% of cement with class F fly ash (option 1) applies to all precast concrete. However, the change of coal composition along with applying control measures by thermal power plants to reduce environmental pollution is gradually leading to a situation of limited or no production of good quality class F ash in future. This research can enable precast industries to prepare in the event when good quality Class F ashes will no longer readily available and validate the use of different SCMs, and thus help TxDOT to increase its system reliability by improving the service life as well as sustainability of precast concrete projects.

Locally Available Materials and Optimization

The change of coal composition along with applying control measures by thermal power plants to reduce environmental pollution is gradually leading to a situation of limited or no production of good quality class F ash in future. The use of blended coal (i.e., a blend of Powder River Basin and lignite coal) along with changes in power plant operations is a common practice by the coal fired power plants to meet emission requirements. This has resulted changes in fly ash composition and dwindling of conventional Class F ash in the market. This combined approach can be effective to test the effectiveness (optimization) of different types of SCMs to

prevent ASR in a rapid and reliable manner and formulate case specific performance-based ASR resistant concrete mixtures using locally available materials (e.g., fly ashes, aggregates, etc.).

Engineering Design Improvement

This applied approach can formulate performance based ASR resistant mixes and ensure long lasting precast concrete. Since the locally available aggregate and SCM materials can be judiciously used and optimized with the applied approach, ASR distress can be minimized to a safer level. Therefore, engineering design on ASR preventive measures can be improved effectively.

VoI Estimation

For VoI (Value of Implementation) submission, the expected value of savings per year has been generated according to the ASR repairing cost reported by TxDOT. Since the 2014 specification (item 789) was created, TxDOT spent a total of $200,000 on repairing damage related to ASR from 2017 to 2019. Therefore, it can be expected that around $100,000 per year can be saved through this implementation project.