Nebraska Department of Roads Evaluation of Statewide Aggregate Reactivity -Phase II

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INTRODUCTION

Phase II of the laboratory investigation is currently underway and serves as a continuation of Phase I. Which, analysis of the test results were based on the AASHTO PP 65-10 (2010) special provision guide, "Determining the Reactivity of Concrete Aggregate and Selecting Appropriate Measures for Preventing Deleterious Expansion in New Construction" and ultimately determine the overall level of risk due to ASR. Through Phase I evaluation, it was found that all aggregate pit locations tested resulted in Moderate to Very Highly Reactive aggregates, as described in Table 2.

Aggregate Location	ASTM C 1293 Results 1 Year (%)	Description of Agg. Reactivity	Aggregate Reactivity Class Table 1-Protocol A
Grand Island	0.09	Moderate Reactive	R1
Kimball	0.21	Highly Reactive	R2
Republican River	0.45	Very Highly Reactive	R3
Scottsbluff	0.15	Moderate Reactive	R2
Ogallala	0.06	Moderate Reactive	R1
Thedford	0.19	Highly Reactive	R2
Fairbury	0.10	Moderate Reactive	R1
Norfolk	0.30	Very Highly Reactive	R3
Linoma	0.15	Moderate Reactive	R2

Table 2 - Nebraska's Aggregate Reactivity Classification

The same aggregate sources analyzed in the initial phase, will be tested according to ASTM C 1293 (Standard Test Method for Determining the Potential Alkali-Silica Reaction) of Combinations of Cementitious Materials using SCM percentage currently specified by NDOR as a IP cement using 25% Class F fly ash replacement (Figure 1).

Figure 1.

ANALYSIS OF AGGREGATE REACTIVY ACCORDING TO AASTHO PP 65-10

The current evaluation has proven NDOR's Standard Specification mitigates all currently used aggregate across the state, as summarized in Table 2. In addition, a database will be created that fully categorizes the reactivity of Nebraska's principal aggregate sources. Also, this study will review past performance of NDOR projects built with SCM's.

Table 2. Nebraska's Aggregate Testing with SCM Percentage currently Specified by NDOR

Aggregate Location	SCM Material	ASTM C 1293 Results 2 Years (%)
Grand Island	IPF (25% Class F Fly Ash)	0.02
Kimball		0.01
Republican River		0.01
Scottsbluff		0.02
Ogallala		0.01
Thedford		0.01
Fairbury		0.01
Norfolk		Completed by September 2012
Linoma		Completed by February 2013

This investigation took a look at NDOR project field performance with reactive aggregates from the category of moderate reactive to very highly reactive aggregate, as summarized in Table 3. Field performance analysis were based on the AASHTO PP 65-10 (2010) special provision guide.

Route Built	Project Number	Cement Type Used	Source of Aggregate	ASTM C 1293 Results 1 Years (%)	Min. Replacement Level of SCM to Provide Levels of Prevention	Reduce the min. amount of SCM one prevention Level due to low alkali Cement- Table 8 - Protocol A	Performance 2011
Chester Hebron 1994	F-81-1(1017)	Type I Added 17% Class F	Grand Island	0.10 Moderate Reactive	20%	15%	
Ansley 2001	S-2-3 (1019)	Type I Added 17 % Class F	Thedford	0.19 Highly Reactive	25%	20%	
Norfolk East 1995	275-5-(1013)	IPF Interground 22% Class F	Norfolk	0.30 Very Highly Reactive	35%	25%	
Norfolk East 2005	F-275-6 (1020)	Led with 98 Spec Type 17% IPN+9% C	Norfolk	0.30 Very Highly Reactive	35%	25%	

Table 3 - Summary of NDOR Projects Field Performance with Reactive Aggregates

Performance review provided a good correlation with the special provision guidance of AASHTO PP65-10 (2010). In fact, the protocol correlates well when reviewing the field performance (Figure 2 and 3) of Ansley built in 2001 using highly reactive aggregate with not enough SCM to mitigate the reaction.

Figure 3 - Field Performance (Highly Reactive Aggregate) Ansley built 2001

Figure 2 - Field Performance (Highly Reactive Aggregate) Ansley built 2001

Comparing the results with NDOR's current specifications for minimum replacement levels when using SCM, it was found the Elkhorn River a Very Highly Reactive aggregate, which required up to 35 percent SCM replacement, could perform well with replacement up to 25 percent SCM as per AASTHO PP 65-10 states when using a low alkali cement. Figure 4 shows Norfolk East project built with 22 percent interground IP with Class F fly ash field performance.

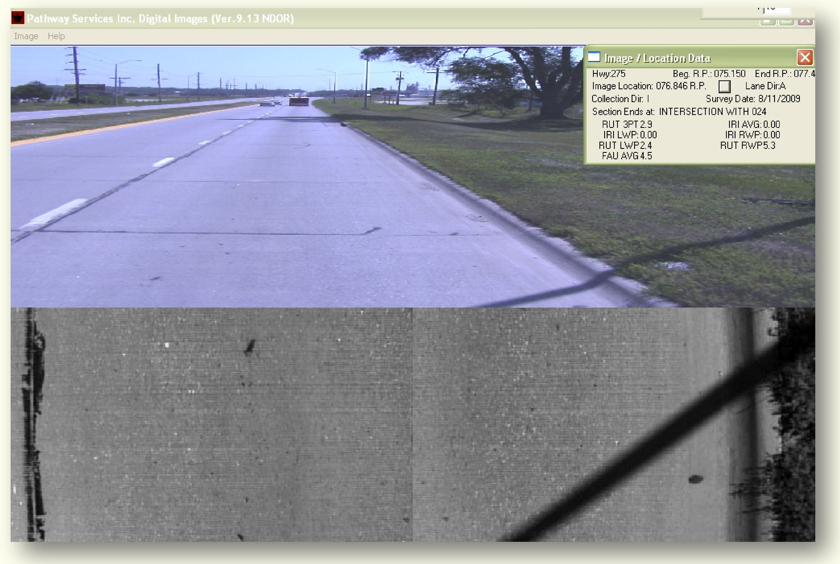

Figure 4 - Field Performance (Very Highly Reactive Aggregate) Norfolk East built 1995

The same correlation was found when evaluating the field performance (Figure 5) of Norfolk East built in 2004 using very highly reactive aggregate with not enough prevention measure to mitigate the reaction.

Figure 5 - Field Performance (Very Highly Reactive Aggregate) Norfolk East built 2004

The analysis of Phase II is guided by the composition of the ashes being used in the evaluation and the classification of aggregate reactivity as per Protocol A. Phase II is in progress.