

March 31, 2014

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REPORT OF TESTS

SUBJECT: **Physical Analysis of Concrete**

PROJECT: **MATRIX Construction Products – Comparative Study**

MATERIALS: Delivered to NTL on February 20, 2014

NTL PROJECT: 14-1033(B)

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TEST METHODS: ASTM A 944, “Standard Test Method for Comparing Bond Strength of Steel Reinforcing Bars to Concrete Using Beam-End Specimens”

TEST OVERVIEW

The purpose of this testing was to examine the effect MATRIX CP product BIG-FOOT® has, if any, on rebar used in the construction of drilled-shaft foundations. For this testing fifteen pullout tests were performed over a range of five slurry viscosities.

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LABORATORY PROCEDURE

1. BIG-FOOT® slurry mixtures were prepared in the Laboratory using 5-gallon buckets, an electric drill with a paddle attachment (similar to that used for mixing grout). Upon filling the 5-gallon bucket with tap water, a small amount of Soda Ash (2 tbsp.) was added to adjust the pH to 9.0. Next, BIG-FOOT granular polymer was slowly added while mixing to ensure thorough hydration of the product. After complete hydration (1-hour), the viscosity was checked from each mixture using a Marsh Funnel and a set of three 6" x 12" cylindrical concrete molds were filled from each mixture, to give a total of fifteen molds.

The five mixtures were as follows:

- a. Tap water with a pH of 8-10.
 - b. Slurry mixed with 4 lb. BIG-FOOT and 7 lb. soda ash per 1,000 gallons of tap water.
 - c. Slurry mixed with 5 lb. BIG-FOOT and 7 lb. soda ash per 1,000 gallons of tap water.
 - d. Slurry mixed with 6 lb. BIG-FOOT and 7 lb. soda ash per 1,000 gallons of tap water.
 - e. Slurry mixed with 8 lb. BIG-FOOT, 4.5 lb. FORTIFY, and 7 lb. soda ash per 1,000 gallons of tap water.
2. One 17" Grade 60 rebar was suspended in the center of each mold, 1" from the bottom, and remained for 2 hours allowing for sufficient exposure of the bottom 11" of rebar to the polymer solutions.
 3. Moving from bottom to top, a PVC tremie pipe was used to fill each mold with Quikrete 5000 concrete, displacing the solution and concreting the rebar in place. Concrete was be mixed and tested to ensure a minimum slump of 7 inches was attained.
 4. The concrete cylinders were allowed to cure for a total of 28 days before testing according to ASTM A 944-10.

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TEST DATA

Batch Date: February 20, 2014
Test Date: March 20, 2014
Concrete: Quikrete 5000
Reinforcement: ASTM 615, #4 Grade 60 deformed bars
Marsh Funnel: Mix B – 55 seconds
Mix C – 59 seconds
Mix D – 60 seconds
Mix E – 92 seconds

TEST RESULTSASTM A 944 – Bond Strength (pounds-force)

Results:

	<u>Sample 1</u>	<u>Sample 2</u>	<u>Sample 3</u>	<u>Average</u>	<u>Std. Dev.</u>
Mix A	21,230 lbf	18,120 lbf	20,880 lbf	20,880 lbf	1,391
Mix B	19,320 lbf	13,520 lbf	13,110 lbf	15,320 lbf	1,833
Mix C	10,590 lbf	9,430 lbf	8,380 lbf	9,470 lbf	903
Mix D	21,140 lbf	20,040 lbf	19,850 lbf	20,340 lbf	569
Mix E	20,290 lbf	13,330 lbf	15,760 lbf	16,460 lbf	2,884

NELSON

TESTING
LABORATORIES

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Respectfully submitted,

NELSON TESTING LABORATORIES



Mark R. Nelson
President

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Addendum – A-1

PICTURES

Quikrete 5000



Marsh Funnel



Bond Strength Specimens



Bond Strength Specimens

