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INSTALLATION OF ADHESIVES TECHNOLOGY CORPORATION ULTRABOND HS-1CC ADHESIVE ANCHOR SYSTEM INSTALLED WITH BOSCH, DEWALT, HILTI AND MILWAUKEE BRAND VACUUM-DRILL BIT SYSTEMS

INTRODUCTION: Element Materials Technology, Saint Paul (Element) performed bond strength testing of the Adhesives Technology Corporation (ATC) ULTRABOND® HS-1CC adhesive anchor system installed in holes drilled in concrete using the Bosch, Dewalt, Hilti and Milwaukee brands of vacuum-drill bit systems. The HS-1CC anchor system was originally tested in holes drilled using a Milwaukee brand vacuum-bit system, which is listed in ICC Evaluation Service, LLC evaluation report ESR-4094.

The purpose of the work was to demonstrate that the HS-1CC may be installed in holes prepared by many commonly available vacuum-bit systems, and need not be limited to only the Milwaukee system. Element has experience testing anchors in holes drilled with several vacuum bit systems, including Bosch, Dewalt, Hilti as well as the Milwaukee brands.

Experience has shown that the efficacy of the vacuum-bit system trended downward as the drill bit size increased, as compared to the various adhesive anchor systems installed in holes drilled with standard bits and cleaned with the more typical air blow-brush-air blow cleaning methods outlined in the several Manufacturer's Published/Printed Installation Instructions (MPII). In consequence, it was decided to test only the largest anchor size (1 1/4" diameter) that the HS-1CC was tested for, using the Bosch, Dewalt, Hilti as well as the Milwaukee brands. Since the HS-1CC was already accepted for use in holes drilled with the Milwaukee system, it was intended to show that installing HS-1CC in holes drilled with the other three systems will be similar or better.

BORE-HOLE CLEANING METHOD & INSTALLATION: In all cases, the holes were drilled with the applicable Bosch, Dewalt, Hilti or Milwaukee vacuum drill bit system. That is, a Bosch bit was used with the Bosch Vacuum, the Dewalt bit with the Dewalt Vacuum, and so on. The drill bits were 1 3/8" SDS MAX bits in all cases except was 35 mm SDS MAX for the Hilti system, which does not have a specific 1 3/8" size. The hole was drilled to approximately 6 inches of depth in all cases, with the vacuum system on self-cleaning mode. No other cleaning was performed after drilling the hole. The 1 1/4" threaded rod anchor elements, which conformed to ASTM A193 Grade B7, were used in all tests, installed in the holes filled with the HS-1CC anchor system.

All tests were performed in the same batch of concrete that was cast on May 4, 2018, without reinforcement of any kind. The compressive strength at the time of testing was estimated to be 3,780 psi.

RESULTS: The intent of the testing was to show equivalence of the bond strengths for the HS-1CC adhesive anchor system installed in the holes prepared with the Milwaukee vacuum-bit system to those prepared with other vacuum-bit systems. For this purpose, it was necessary to show the data from each of the other vacuum-bit systems have bond strengths that are equal to or greater than the bond strength from the Milwaukee vacuum-bit system.

Table: Summary of Assessment of the Test Data

Vac System	$\tau_{u,mean}$ (psi)	v	$\tau_{u,5\%}$ (psi)
Milwaukee	3241	0.063	2550
Dewalt	2916	0.041	2588
Bosch	3754	0.034	3315
Hilti	3428	0.047	2881

From the data shown in the Table the mean and characteristic bond strengths developed for the HS-1CC installed in holes prepared with the Bosch and the Hilti vacuum-bit systems is greater than that for the Milwaukee system, and while the mean value is somewhat lower for the Dewalt system, the characteristic value is slightly higher than Milwaukee system.

CONCLUSION: Based on an analysis of the data, the HS-1CC can be used with any of the four tested vacuum-bit systems to develop the bond strengths as previously derived for the anchor system. The Milwaukee vacuum-bit system is already a proven system for the HS-1CC, and the results of this project indicate the other commonly available vacuum-bit systems will achieve the necessary performance for the HS-1CC as well.