شبكة المعلومات الجامعية

بسم اللّه الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

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قسم

نقسم باللّه العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

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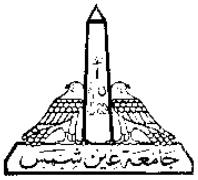

AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Structural Engineering

Evaluation of Bond Strength of Basalt FRP Bars under Severe Conditions

A Thesis submitted in partial fulfillment of the requirements of the degree of

Master of Science in Civil Engineering

(Structural Engineering)

by

Mohamed Heshmat Mahmoud Abd El-Aziz

Bachelor of Science in Civil Engineering
(Structural Engineering)
Faculty of Engineering, Ain shams, 2016

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STATEMENT

This thesis is submitted as partial fulfillment of Master of Science in Civil Engineering (Structural Engineering), Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

Mohamed Heshmat

Signature

……..……

Date: / /

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ABSTRACT

The fiber-reinforced polymers (FRPs) bars proved their efficiency as a feasible solution for the corrosion problem that steel bars suffer from, and they are increasingly becoming an alternative to steel rebars, especially in bridges construction, as a result of the increased need for the FRP technology, a lot of researches launched to introduce new fibers that have the potential to produce a corrosion-resistant, durable and cost-effective solution when implemented in concrete structures, such as basalt FRP (BFRP).

The fundamental studies and relevant applications of BFRP bars are still limited, thus the available specifications and design codes don't provide any recommendations related to them, therefore, to better characterize and understand the behavior and performance of BFRP bars in concrete structures new researches are needed.

The main objective of this experimental study is to evaluate the bond strength of newly produced BFRP bars in the short and long term when exposed to severe environments and provide the results to help introduce these new reinforcing bars to the specifications and design codes.

The experimental tests were achieved through two stages. The first stage was conducted to investigate the mechanical properties of the BFRP bars used in this study (unconditioned reference values). Concrete specimens were cast to determine the effect of varying parameters on the bond strength. Parameters such as concrete compressive strength and embedment length were studied. The second stage was conducted to investigate the long-term performance of BFRP bars by exposing the BFRP bars to harsh environments (Alkaline, Salt, and water). Subsequently, the bond strength was assessed and compared with the unconditioned (reference) values.

The results of the first stage that characterize the mechanical properties of the BFRP bars proved that the BFRP bars satisfy the minimum requirements of the FRP specifications such as ACI 440.6M-08 and CSA S807-10.

The second stage proved that the exposure to the alkaline and salts solutions had a negligible effect on the bond strength-end slip curves, the fiber-resin interface is the key parameter in the degradation process of the BFRP bars bond, and the main reason for failure for both control and conditioned specimens was the interlaminar shear between the BFRP layers.

Increasing the bonded length increased the reduction exhibited in the bond strength when exposed to the alkaline solution (20% for 7.5d, 13% for 5.0d, and 7% for 2.5d) as the degradation of the bar surface was the governing cause of failure. Decreasing the concrete compressive strength increased the reduction exhibited in the bond strength when exposed to the alkaline solution (17% for 25 MPa, 13% for 45 MPa, and 9% for 60 MPa).

Keywords: Basalt bar, Fiber-reinforced polymers (FRP), Bond, Durability, Saline, Alkaline, Pull out, Aging.

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