Accepted Manuscript

Experimental Testing of Basalt-Fiber-Reinforced Polymer Bars in Concrete Beams

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PII: S1359-8368(16)00086-X

DOI: 10.1016/j.compositesb.2016.01.045

Reference: JCOMB 4024

To appear in: *Composites Part B*

Received Date: 20 November 2015

Revised Date: 22 January 2016

Accepted Date: 25 January 2016

Please cite this article as: Elgabbas F, Vincent P, Ahmed EA, Benmokrane B, Experimental Testing of Basalt-Fiber-Reinforced Polymer Bars in Concrete Beams, *Composites Part B* (2016), doi: 10.1016/j.compositesb.2016.01.045.

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ABSTRACT

The advances in fiber-reinforced-polymer (FRP) technology have spurred interest in introducing new fibers, such as basalt, in addition to the commonly used glass, carbon, and aramid. Recently, new basalt-FRP (BFRP) bars have been developed, but research is needed to characterize and understand how BFRP bars would behave in concrete members. This paper presents an experimental study aimed at determining the bond-dependent coefficient (k_b) and investigating the structural performance of newly developed BFRPs in concrete beams. A total of six concrete beams reinforced with BFRP bars were built and tested up to failure. The test beams measured 200 mm wide, 300 mm high, and 3100 mm long. Ten, 12, and 16 mm BFRP bars with sand-coated surfaces over helical wrapping were used. The beam specimens were designed in accordance with Annex S of CSA S806-12 and tested under four-point bending over a clear span of 2700 mm until failure. The beam test results are introduced and discussed in terms of cracking behavior, deflection, and failure modes. The test results yielded an average k_b of 0.76, which is in agreement with the CSA S6-14 recommendation of 0.8 for sand-coated bars. Moreover, comparing the results to code provisions showed that CSA S806-12 may yield reasonable yet conservative deflection predictions at service load for the beams reinforced with BFRP bars.

***Keywords*:** Beams, basalt-fiber-reinforced polymer (BFRP), deflection, flexure, crack width, bond-dependent coefficient, and serviceability.