Strengthening of Reinforced Concrete L-Beams Subjected to Pure Torsion

A Thesis
Submitted to the Faculty of Engineering
Ain Shames University for the Fulfillment
of the Requirement of M.Sc. Degree
In Civil Engineering (Structural)

Prepared by

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B.Sc. in Civil Engineering, June 2008
Higher Institute of Engineering – El Shorouk Academy

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THESIS APPROVAL

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Date: 16/4/2014

STATEMENT

This thesis is submitted to AIN SHAMS UNIVERSITY in partial fulfillment of the requirements for the degree of Master of Science in Civil Engineering (Structural).

The work included in this thesis was carried out by author in the Department of Structural Engineering, faculty of Engineering, Ain Shams University.

No part of this thesis has been submitted for a degree of qualification at any other university or institute.

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

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AIN SHAMS UNIVERSITY

FUVULTY OF ENGINEERING

STRUCTURAL ENGINEERING DEPARTMENT

Abstract of the M.sc. Thesis submitted by

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Title of Thesis:

Strengthening of Reinforced Concrete L-Beams Subjected to Pure Torsion

Supervisors:

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Abstract:

Torsion failure is an undesirable brittle form of failure. In the design of many structures and under service conditions, torsion plays a significant role. Significant torsion occurs in structural members of buildings such as girders supporting eccentric columns or asymmetric slabs as well as spandrel beams and edge beams supporting cantilever floor slabs.

During the last few decades, several advantages of strengthening concrete elements using Fiber Reinforced Polymer (FRP) have emerged. The use of this material is since been accepted by designers due to its superior properties, which include high strength to weight ratio, non-corrosiveness, and ease of installation.

The objective of this research is to investigate the behavior of RC L-shaped specimens strengthened by using carbon fiber reinforced polymers and subjected to pure torsion. The effect of different parameters such as fiber orientation and using mechanical anchors were observed in addition to FRP.

The experimental program included five L-shaped specimens tested under pure torsion. All specimens had the same stirrups, longitudinal steel bars, and concrete dimensions.

- All specimens were flanged with L-shaped cross-section and dimensions bw/hw/bf/tf = 150/350/300/150 mm
- The first specimen was unstrengthened (control specimen), the other specimens strengthened using CFRP strips with different orientation
- Only two specimens were strengthened using CFRP strips with anchoring system

The experimental results were compared with the theoretical calculations from the Egyptian, ACI, and CSA code provisions.

Table of Contents

Chapter 7: Code Predictions

Chapter 8: Summary and Conclusions

References

List of Figures

Page

Chapter 2

Chapter 3

Chapter 4

Chapter 5

CHAPTER 6

CHAPTER 7