Available online at www.CivileJournal.org

Civil Engineering Journal

Vol. 5, No. 2, February, 2019

Behavior of Laminated Reinforced Concrete Curved Beam with Changing Concrete Properties

Hesham A. Numan [a*], Waleed A. Waryosh [a], Shaima Sabri Ali [a]

[a] *Civil Engineering Department, Faculty of Engineering, Al-Mustansiriayah University, Baghdad 10052, Iraq.*

Received 11 December 2018; Accepted 07 February 2019

Abstract

Strengthening and upgrading the performance reinforced concrete curved structures for functional purpose as well as for conversation of architectural aesthetic aspect is the main concern for engineers. In the present study, four full-scale experimental Curved Reinforced Concrete (CRC) beams conducted. The cross-section of all CRC beams was T-section. The parametric studies are carried out to investigate the effect of time of casting segmental layers (web and flange) and the compressive strength of concrete on the structural behavior of such structures. Three values of compressive strength of concrete used in this study, these are (25, 50, 75 MPa). The control specimen casting as one unit with the compressive strength of concrete was 25 MPa. The present outcomes showed that the increase in the compressive strength of concrete up to 75 MPa of the flange zone plays a significant role in raising the ultimate capacity by 22.86% and reducing the deflection by 61.43% in the quarter span as compared with control specimen. Additionally, the trend and distribution of cracks, mode of failure, and strain response of CRC specimens are briefly discussed in this study.

Keywords: Curved Reinforced Concrete; Compressive Strength; Time of Casting; Laminated Structure.

1. Introduction

The major feature of the CRC structure is that, if the curve is fittingly shaped, the whole cross-section can be used in compression under the extreme (complete) load [1]. As CRC structure has been an engineering and scientific topic for more than three centuries; many methods such as graphical methods have been presented to analyze this kind of structure [2].

Several analyzes suggested by (Khalifa [3]; McMullen et al. [4]; Hsu et al. [5]; Mansur and Rangan [6]; Franciosi [7]) to study the collapse for certain cases of CRC beams. By using the finite element method, Zhenfei and Dawen [8] analyzed the indeterminate CRC. The outcomes of this study referred that the actual performance of the CRC was nonlinear. The hinged circular arch investigated by Yang and Shieh [9] through dividing the arch to twenty-five straight elements with equal length with assuming two load cases. Under the effects of live load, a full span of reinforced arch culvert bridge modeled and analyzed by McGrath and Mastroianni [10]. The main conclusion of this study that the two-dimensional models have limited ability to foretell the longitudinal spreading of live load forces in the culverts. A nonlinear three-dimensional finite element simulation carried out by Husain et al. [11] to analyze the effect of the curvature (L/R ratio of 0, 0.1, 0.15 and 0.2) on the demeanor of the curved in plan composite concrete beams. Kang and Tan [12] used the energy balance hypothesis to estimate the compressive arch action of reinforced concrete beam-column subassemblages. Falamarz-Sheikhabadi et al. [13] conducted an analysis study on the tall long-span curved reinforced-concrete under time history response to uniform and spatially variable seismic excitations, nonlinear static pushover, and incremental dynamic methodology to assess the structural performance for such construction.

* Corresponding author: dr.heshamnuman@uomustansiriyah.edu.iq

http://dx.doi.org/10.28991/cej-2019-03091244