Manuscript ID : 00000-53856

Source ID : 00000001

International Journal of Civil Engineering and Technology

Volume 10, Issue 1, January 2019, Pages 188-201, Page Count - 14

EXPERIMENTAL STUDY ON THE BEHAVIOR AND STRENGTH OF REINFORCED CONCRETE CORBELS CAST WITH SELF-COMPACTING CONCRETE INCORPORATING RECYCLED CONCRETE AS COARSE AGGREGATE

Emadaldeen A. Sulaiman [(1)] Jamal A. Samad Khudair [(2)]

[(1)] Assistant Lecturer, Civil Engineering Department, College of Engineering, Basrah University, Basrah, Iraq.
[(2)] Assistant Professor, Civil Engineering Department, College of Engineering, Basrah University, Basrah, Iraq.

Abstract

This paper deals with the effect of using recycled concrete aggregate as a partial replacement of coarse aggregate in self-compacting concrete, on the structural behavior of reinforced concrete corbels. From the previous researches, there is no studies deals with the effect of using this type of aggregate on the structural behavior of corbels, and also the use of RCA has an economical and environmental benefits Three replacement ratios were considered 25%, 50% and 75%. All mixes (with and without RCA) have almost same compressive strength at age of 28days which is equal to (35MPa) with a tolerance of (±3MPa).For this purpose, an eleven reinforced concrete corbels were cast and divided in to three groups (A, Band C). Each group deals with specific problem. Different parameters which effect the behavior of corbels were studied and include replacement ratios of natural coarse aggregate by recycled concrete aggregate (RCA), amount of horizontal reinforcement (Ah) and amount of main tension reinforcement (As_{main}).

In order to get same compressive strength of concrete mixes made with natural and with recycled concrete aggregates, the quantity of cement was increased by (1.25%, 3.75% and 10%) for mixes containing (25%, 50% and 75%) recycled concrete aggregate respectively compared with SCC made with natural coarse aggregate.

*The experimental results of corbels show that the ultimate load capacity of corbels in group Atested with a/d of 0.34 and made from SCC with (25%, 50 and 75%) RCA was decreased by (2.22%, 7.4%, and 12.34%) respectively compared with corbel made from SCC without RCA. While in group **B**, all corbels casted with 50%RCA and have the same main tension reinforcement, a/d=0.34, corbel dimensions and concrete compressive strength and the only difference was in the amount of horizontal reinforcement. The results showed that when the amount of horizontal reinforcement (stirrups) was increased from zero to 2Ø6mm, the ultimate load increased by (15.55%). While when the horizontal reinforcement was increased from 2Ø6mm to 3Ø6mm the ultimate load increased by 50%. Also the ultimate load was increased by 76.22% when the amount of horizontal reinforcement increased from zero to 4Ø6mm.*

In group C, all corbels were casted with50% RCA and tested under a/d=0.6. All corbels having the same geometry, horizontal reinforcement and a/d ratio and the only difference was in the main tension reinforcement. From the results it was noted that the increase in main tension reinforcement from 2Ø10mm to 3Ø12mm causes an increase in ultimate load by about 19.04%. When the main tension reinforcement was increased from 2Ø10mm to 2Ø16mm, the ultimate load was increased by 22.61%.

There for it can be concluded that the recycled concrete aggregate can be used as a partial replacement of natural coarse aggregate to produce self-compacting concrete mixes and the behavior of corbels cast with SCC containing RCA is acceptable.

Author Keywords

Recycled concrete aggregate, ultimate strength, corbel

ISSN Print: 0976-6308
ISSN Online: 0976-6316
Source Type: Journals
Document Type: Journal Article
Publication Language: English
DOI:
Abbreviated Journal Title: IJCIET
Access Type: Open Access
Publisher Name: IAEME Publication
Resource Licence: CC BY-NC
Major Subject: Physical Sciences
Subject Area classification: Engineering and Technology
Subject area: Civil and Structural Engineering
Source: SCOPEDATABASE

Reference

References (12)

1. EFNARC
   Specification and Guidelines for Self-Compacting Concrete

   (2002) The European Federation Dedicated to Specialist Construction Chemicals and Concrete Systems, Page No 32,

2. Okamura H., Ouchi M
   Self-compacting concrete

   (2003) Journal of Advanced Concrete Technology, Volume 1, Issue 1, Page No 5-15,

3. Goodier, C
   Self-Compacting Concrete

   (2001) European Network of Building Research Institutes, Issue 17, Page No 6,

4. Khayat K.H
   Workability, testing, and performance of self-consolidating concrete

   (1999) ACI Materials Journal, Volume 96, Issue 3, Page No 346-353,

5. Hassan and Kadhim Naief Kadhim
   DEVELOPMENT AN EQUATIONS FOR FLOW OVER WEIRS USING MNLR AND CFD SIMULATION APPROACHES

   (2018) International Journal of Civil Engineering and Technology, Volume 9, Issue 3,

6. ACI Committee 318
   Building Code Requirements for Structural Concrete and Commentary (ACI 318M-2014)

   (2014) American Concrete Institute,

7. Yang, J., Lee, J., Ashour, Y., Cook, W., & Mitchell, D
   Influence of steel fibers and headed bars on the serviceability of high-strength concrete corbels

   (2012) Journal of Structural Engineering, Volume 138, Issue 1, Page No 123–129,

8. Foster, S.J., and Gilbert, R. I
   Design of Non-flexural members using 20-100 MPa concretes

   (1994) ASEA Conference, Page No 34- 72,

9. A.H. Mattock, K.C. Chen, K. Soongswang
The Behavior of Reinforced Concrete Corbels

(1976) Journal of Prestressed Concrete Structure, Page No 53–77,

10. Aziz,O.O. and Othman Z.S
Ultimate Shear Strength of Reinforced High Strength Concrete Corbels Subjected To Vertical Load

(2010) Al-Rafidain Engineering Journal, Volume 18, Issue 1,

11. IQS No. 45/1984
``Aggregate from Natural Sources for Concrete`` Central Agency for Standardization and Quality Control, Planning Council, Baghdad Iraq

12. ASTM A615
Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

(2009) Annual Book of American Society for Testing Concrete and Materials,