Cairo University

EFFECT OF RECYLCED COARSE AGGREGATE ON PHYSICAL AND MECHANICAL PROPERTIES OF CONCRETE

By

MOSTAFA MAGDY SOLIMAN ASHMAWY

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
STRUCTURAL ENGINEERING

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Title of Thesis:

"Effect of Recycled Coarse Aggregate on Physical and Mechanical Properties of Concrete ".

Key Words:
Recycled aggregate; Mechanical properties; Physical properties; Columns; Axial loading.

Summary:

Experimental program has been conducted in this research to examine physical and mechanical properties of recycled coarse aggregate (RCA) made from crashing of standard concrete cubes. The studied properties include specific gravity, water absorption, bulk density and crushing index. These properties are compared to their counterparts obtained from natural coarse aggregate (NCA). The research also aims to study the effect of using the RCA on the mechanical properties of concrete. Different RCA ratios are used in constructing reinforced concrete columns to study their crack pattern, failure load, load- displacement relation, load-strain relation for longitudinal and transversal reinforcement, toughness and stiffness. The study includes four groups of specimens with 0%, 30%, 50% and 100% RCA replacement ratios. Six cubes, cylinders and small beams are constructed from each group to estimate the compressive, splitting and flexure strength at the age of 7 and 28 days. The research shows that RCA is a good alternative to NCA and the optimum RCA replacement ratio is 50%.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

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List of Symbols, Abbreviations and Nomenclature

RCA	Recycled coarse aggregate
NCA.	Natural coarse aggregate
FA.	Fine aggregate
b	Width of columns' cross section
t	Length of columns' cross section
h	Height of column
f_{cu}	Cube compressive strength
f_t	Cylinder splitting strength
f_y	Yield stress of the longitudinal reinforcement
Cu-ref	Reference concrete cubes
Cu-30	Concrete cubes with 30% recycled coarse aggregate
Cu-50	Concrete cubes with 50% recycled coarse aggregate
Cu-100	Concrete cubes with 100% recycled coarse aggregate
Be-ref	Reference concrete beams
Be-30	Concrete beams with 30% recycled coarse aggregate
Be-50	Concrete beams with 50% recycled coarse aggregate
Be-100	Concrete beams with 100% recycled coarse aggregate
Cy-ref	Reference concrete cylinders
Cy-30	Concrete cylinders with 30% recycled coarse aggregate
Cy-50	Concrete cylinders with 50% recycled coarse aggregate
Cy-100	Concrete cylinders with 100% recycled coarse aggregate

SG	Specific gravity
BD.	Bulk density
WA.	Water absorption
CI	Crushing index
d_0	Nominal aggregate size
$A_{st.}$	Area of column section
$A_{g.}$	Area of steel
$P_{o.}$	Ultimate load