

**Tension Stiffening Effect
in
Normal, Self Compacting
and High Strength Concrete**

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P R E F A C E

Dedicated to all the Scholar's and Students of Civil Engineering.
Constructive feedback is cordially invited.

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DEDICATED
TO
OUR BELOVED PARENTS
FOR
THEIR LOVE AND SUPPORT

ABSTRACT

Tension stiffening effect is an important phenomenon to be understood before applying it to the structural concrete. It has been observed from the literature the cracking and deformation behavior of the structural concrete depends on the tension stiffening. This investigation presents the structural response of reinforced concrete under direct tension to understand the tension stiffening effect. The variables are normal strength concrete (NSC), High strength concrete (HSC), and self-compacting concrete with different diameter reinforcing bars. This investigation covers the interaction of structural steel reinforcement and concrete in uniaxial tension. A large number of studies are available with respect to several parameters viz., different grades of concrete, diameter of bars, transverse cracks, splitting cracks, crack widths, bar-bond behavior, use of steel fibers etc. in tension stiffening.

An experimental program has been designed to mix, cast and test three different grades of concrete viz. M20, M30, M40 SCC. The different diameters of bars used are 10mm, 12mm and 16mm. All specimens were cast in wooden moulds; concrete was poured in three layers and compacted by vibration. The test was carried out after 28 days of casting. The experimental constants are the geometry of specimen (100×100×400) mm as well as the test set up.

A procedure of trials was adopted to find a suitable mix design in which IS method of proportioning was used for M20 and M30 and a method proposed by "Nan Su et al" has been used for proportioning of SCC. The cracking pattern, first cracking load, stress-strain relation and ultimate failure behavior were experimentally studied.

CONTENTS

NOTATIONS

LIST OF FIGURES

LIST OF TABLES

1.	INTRODUCTION	01
2.	LITERATURE REVIEW	03
2.1	FINDINGS OF LITERATURE REVIEW	12
3.	SCOPE OF PRESENT INVESTIGATION	14
4.	MIX DESIGN AND MATERIALS	16
4.1	FACTORS AFFECTING THE CHOICE OF MIX PROPORTIONS.....	17
4.2	REQUIREMENTS OF CONCRETE MIX DESIGN	17
4.3	TYPES OF MIXES	18
4.4	FACTORS TO BE CONSIDERED FOR MIX DESIGN	18
4.5	MIX DESIGN PROCEDURE.....	19
4.5.1	IS METHOD OF MIX DESIGN	19
4.5.2	NAN SU METHOD	20
4.6	TESTS FOR WORKABILITY OF CONCRETE	22
4.6.1	SLUMP TEST	22
4.6.2	VEE BEE TEST.....	24
4.6.3	L-BOX TEST	25
4.6.4	SLUMP FLOW TEST.....	26
4.7	TEST FOR COMPRESSIVE STRENGTH OF CONCRETE	27
4.8	MIX DESIGN FOR DIFFERENT GRADES OF CONCRETE USED	30
4.8.1	MATERIALS USED IN PRESENT INVESTIGATION	30
4.8.2	MIX DESIGN CALCULATION FOR NSC/M20 CONCRETE.....	31
4.8.3	REQUIRED QUANTITIES OF MATERIALS FOR NSC/M20	31
4.8.4	REQUIRED QUANTITIES OF MATERIAL FOR SCC/M30	32
4.8.5	REQUIRED QUANTITIES OF MATERIAL FOR HSC/M70.....	32
5.	EXPERIMENTAL INVESTIGATION	33
5.1	TEST SPECIMEN DIMENSION.....	34
5.2	PREPARATION OF FORMWORK	35
5.3	MIXING OF CONCRETE AND CASTING OF SPECIMEN	35
5.4	CUBE STRENGTH VALUES.....	37
5.5	TEST SETUP AND INSTRUMENTATION	38
5.6	TESTING PROCEDURE.....	39
5.7	HISTORY OF FAILURE OF SPECIMENS.....	41
5.7.1	M20 NSC/10D	41
5.7.2	M20 NSC/12D	42
5.7.3	M20 NSC/16D	42
5.7.4	M30 SCC/10D.....	43
5.7.5	M30 SCC/12D.....	44
5.7.6	M30 SCC/16D.....	44
5.7.7	M70 HSC/10D	45

5.7.8	M70 HSC/12D	46
5.7.9	M70 HSC/16D	46
5.8	TYPICAL LOAD DEFORMATION CURVES.....	47
6.	ANALYSIS OF TEST RESULTS	50
7.	CONCLUSION	54
8.	SCOPE OF FUTURE INVESTIGATION.....	57
9.	REFERENCES.....	59

NOTATIONS

UPPER CASE LETTERS

A_{st} = Area of total tensile reinforcement, mm^2

P_{cr} = Cracking load, KN

P_u = Ultimate load, KN

P_{br} = Breaking load, KN

V = Absolute volume of concrete

S_c = Specific gravity of cement

W = Mass of water per cubic metre of concrete, kg

C = mass of cement per cubic metre of concrete, kg

p = ratio of fine aggregate to total aggregate by absolute volume

f_a, C_a = total masses of fine and coarse aggregates, per cubic metre of concrete, respectively, kg

S_{fa}, S_{ca} = specific gravities of saturated surface dry fine and coarse aggregates

LOWER CASE LETTERS

f_{ck} = Target mean strength, MPa

f_{ck} = characteristic strength, MPa

s = Standard deviation

b = Breadth of the specimen

d = Depth of the specimen

d_b = Diameter of the reinforcing bar

GREEK LETTER

ρ = Reinforcement ratio

Δ_{cr} = Deformation at cracking load

Δ_u = Deformation at ultimate load

Δ_w = Deformation at working load

Δ_{br} = Deformation at breaking load

Δ_y = Ductility

ABBREVIATIONS

HSC = High strength concrete

NSC = Normal strength concrete

SCC = Self compacting concrete

MPa = Mega Pascal

LIST OF FIGURES

FIG. 4.1 (A), (B), (C) – SLUMP TEST FOR NSC/M20.....	23
FIG. 4.2 – VEE BEE TEST APPARATUS	24
FIG. 4.3 – L-BOX TEST.....	25
FIG. 4.4 – SLUMP CONE TEST	26
FIG. 4.5 (A), (B), (C), (D) – COMPRESSION TEST.....	29
FIG. 5.1 – PLAN AND ISOMETRIC VIEW OF SPECIMEN	34
FIG. 5.2 (A), (B), (C), (D) – CASTING OF SPECIMEN AND CUBES.....	36
FIG. 5.3 – UNIVERSAL TESTING MACHINE.....	40
FIG. 5.4 – CRACK PATTERN FOR M20/NSC 10D	41
FIG. 5.5 - CRACK PATTERN FOR M20/NSC 12D.....	42
FIG. 5.6 - CRACK PATTERN FOR M20/NSC 16D	42
FIG. 5.7 - CRACK PATTERN FOR M30/SCC 10D.....	43
FIG. 5.8 - CRACK PATTERN FOR M30/SCC 12D.....	44
FIG. 5.9 - CRACK PATTERN FOR M30/SCC 16D.....	44
FIG. 5.10 - CRACK PATTERN FOR M70/HSC 10D	45
FIG. 5.11 - CRACK PATTERN FOR M70/HSC 12D	46
FIG. 5.12 - CRACK PATTERN FOR M70/HSC 16D	46
FIG. 5.13 – FIG. 5.18 – TYPICAL LOAD DEFORMATION CURVES	47-49

LIST OF TABLES

TABLE 4.1 – STANDARD DEVIATION TABLE	19
TABLE 4.2 – PROPERTIES OF CEMENT	30
TABLE 4.3 – MIX DESIGN FOR NSC/M20 CONCRETE	31
TABLE 4.4 – MIX DESIGN FOR SCC/M30 CONCRETE.....	32
TABLE 4.5 – MIX DESIGN FOR HSC/M70 CONCRETE	32
TABLE 5.1 – SPECIMEN DIMENSIONS.....	34
TABLE 5.2 – COMPRESSION TEST VALUE FOR NSC/M20	37
TABLE 5.3 – COMPRESSION TEST VALUE FOR SCC/M30.....	37
TABLE 5.4 – COMPRESSION TEST VALUE FOR HSC/M70	37
TABLE 6.1 – ANALYSIS OF SPECIMEN REINFORCED WITH 10MM BAR.....	51
TABLE 6.2 – ANALYSIS OF SPECIMEN REINFORCED WITH 12MM BAR.....	52
TABLE 6.3 – ANALYSIS OF SPECIMEN REINFORCED WITH 16MM BAR.....	52