Table 11: Effect of the Amount of longitudinal reinforcement on confined concrete strength

Column Label	Longitudinal Reinforcement		$f_{y.long.}$	S	$P_{F.A.A}$	$P_{C.C}$	f'_{cc}	f'_{co}	$\frac{f'_{cc}}{f'_{co}}$
	No.	Diam. mm	MPa	mm	KN	KN	MPa	MPa	
C - 1-12 T10	12	10	501	80	3598	3127	48.9	35.28	1.39
C - 1	12	12	501	80	3791	3111	48.6	35.28	1.38
C - 1-12 T14	12	14	501	80	4058	3133	49.0	35.28	1.39
C - 1-12 T16	12	16	501	80	4341	3133	49.0	35.28	1.39
C - 1-12 T18	12	18	501	80	4664	3135	49.0	35.28	1.39
C - 1-12 T20	12	20	501	80	5007	3119	48.7	35.28	1.38

5. CONCLUSIONS

The following conclusions can be drawn based on this study:

- The strength and ductility of confined concrete increase with an increase in volumetric ratio. However, the improvement in confinement due to the increase in area ratio of transverse reinforcement does not continue at the same rate, so 0.035 can be used as an upper limit for the value of area ratio of transverse reinforcement.
- The strength and ductility of confined concrete increase with an increase in ties reinforcement yield stress. However, this increment stopped despite increasing the yield stress limit; it is indicated that the yield strength of transverse reinforcement is not fully used for confinement effect. Moreover, it is necessary to use effective stress instead of the yield stress value to estimate the enhancement in confined strength and ductility. It is noted that the effective stress value does not depend only on transverse steel yield stress, but it is significantly affected by concrete strength, amount of transverse reinforcement and vertical and horizontal spacing between ties.
- The arrangement of the transverse reinforcement has been shown to have significant effects on strength and ductility of normal and high strength concrete columns.
- Closer spacing of transverse reinforcement is known to increase the uniformity of lateral pressure and effectiveness of reinforcement confinement.
- The amount of longitudinal reinforcement has no significant effect on the strength of confined concrete. The main advantage of using larger amount of

longitudinal reinforcement is to prevent premature buckling of longitudinal bars.

NOTATIONS

f'_{cc} : Confined concrete compressive strength in member.
f'_{co} : Unconfined concrete compressive strength in member
f'_{c} : Ultimate compressive strength concrete obtained from standard cylinder test
f_{test} : Maximum Stress carried by concrete core as observed in test
$f_{y.long}$: Yield stress for the longitudinal reinforcement
$f_{y.ties}$: Yield stress for the transversal reinforcement
$P_{C.C}$: Maximum load carried by concrete core
$P_{F.A.A}$: Maximum axial load carried by column as observed in the ANSYS model.
P_{Test} : Maximum axial load carried by column as observed in the test
S : Spacing of transverse reinforcement in a longitudinal direction.
ρ_{ties} : area ratio of transverse reinforcement.

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