Influence of Granite Cutting Waste and Recycled Concrete on Properties of Self Compacting Concrete

G.Ganesh Naidu, M.Sri Durga Vara Prasad, N.Narendra

Abstract*: This paper explains the combined effect of granite cutting waste and recycled concrete on the workability and mechanical properties of self compacting concrete. Experimental plan is divided in such a way that granite cutting waste is replaced with fine aggregate at 0, 20,40,60,80 and 100% proportions. Recycled concrete is replaced with the coarse aggregate starting from 20 to 100%. Total 36 mixes were designed to check the fresh and hardened properties. Slump flow and T500, v-funnel and L-box test are conducted to know the flow ability and passing ability of concrete. To study the hardened properties compressive strength, flexural strength test values are to be collected.

***Keywords*: self-compacting concrete, granite cutting (GC) waste, recycled concrete (RC), mix design, properties.**

I. INTRODUCTION

Self-compacting concrete (SCC) is one of the sustainable concrete used in the construction industry. Importance of SCC is increasing day-by-day due to its advantages. Prominence of SCC is elevated by some factors like ease of placing, non requirement of vibration, high strength values compared to conventional concrete

. In this study, granite waste is used as replacement of fine aggregate and coarse aggregate is replaced with recycled concrete. Major scope of study is to decrease the solid waste and to use major non degradable solids. To improve the process both the materials are combined and each material importance in SCC is studied.

II. MATERIALS

Materials used in this study are ordinary Portland cement, river sand as fine aggregate, 10mm coarse aggregate, class F fly ash as filler material, water reducing agent. Granite cutting waste is sieved through 4.75mm, 2.36mm, 1.18mm, 600 microns, 300 microns and 150microns. Grain size distribution graph of GC waste and recycled aggregate is plotted in Fig.1.

III. MIX DESIGN

A total of 36 mixes were designed be replacing fine and coarse aggregates with GC waste and recycled concrete respectively. Clear view of mix designs is shown in the table 1

Revised Manuscript Received on November 15, 2019

Table 1: mix proportions of SCC using GC waste and RC

mix	Cement (kg/m3)	FA (kg/m3)	CA (kg/m3)	Water (kg/m3)	GC waste (%)	RC (%)
1	398	1020	681	221	0	0
			554.8			20
			408.6			40
			272.4			60
			136.2			80
			0			100
2	398	816	681	221	20	0
			554.8			20
			408.6			40
			272.4			60
			136.2			80
			0			100
3	398	612	681	221	40	0
			554.8			20
			408.6			40
			272.4			60
			136.2			80
			0			100
4	398	408	681	221	60	0
			554.8			20
			408.6			40
			272.4			60
			136.2			80
			0			100
5	398	204	681	221	80	0
			554.8			20
			408.6			40
			272.4			60
			136.2			80
			0			100
6	398	0	681	221	100	0
			554.8			20
			408.6			40
			272.4			60
			136.2			80
			0			100

IV. TEST RESULTS

a) SLUMP FLOW:

Slump flow values of different proportions of GC waste and RC were tested and comparison graphs are plotted

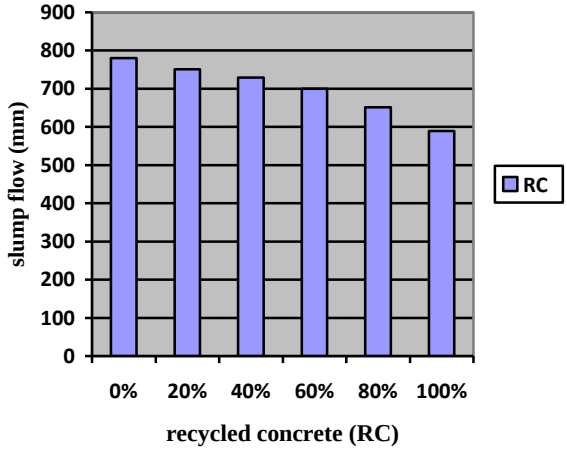

Figure 1: slump values of SCC with GC waste as 0% replacement with fine aggregate

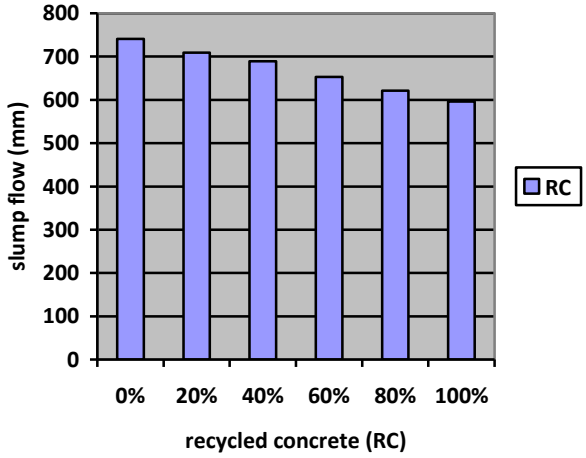

Figure 4: slump values of SCC with GC waste as 60% replacement with fine aggregate

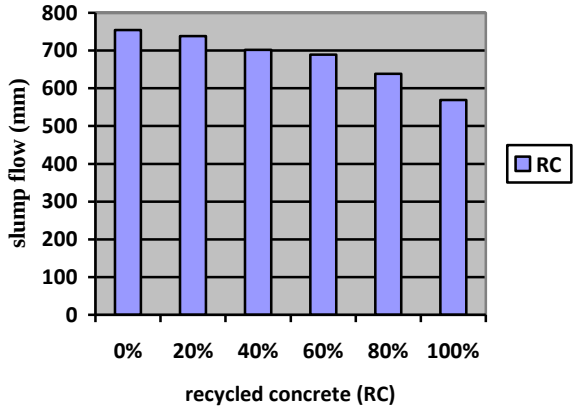

Figure 2: slump values of SCC with GC waste as 20% replacement with fine aggregate

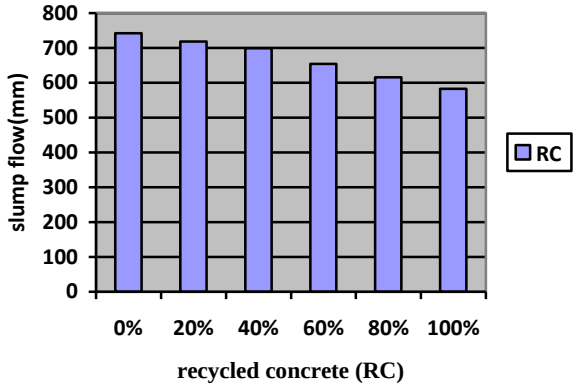

Figure 5: slump values of SCC with GC waste as 80% replacement with fine aggregate

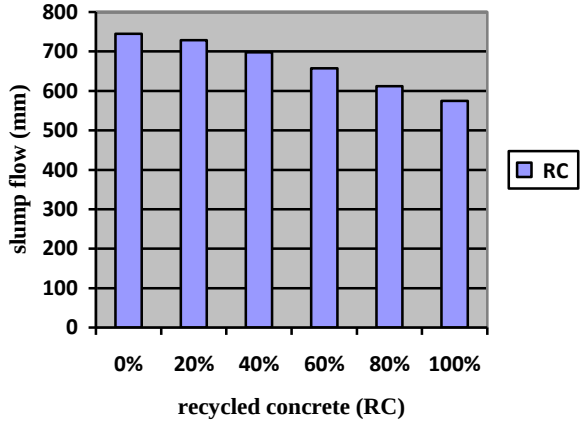

Figure 3: slump value of SCC with GC waste as 40% replacement to fine aggregate

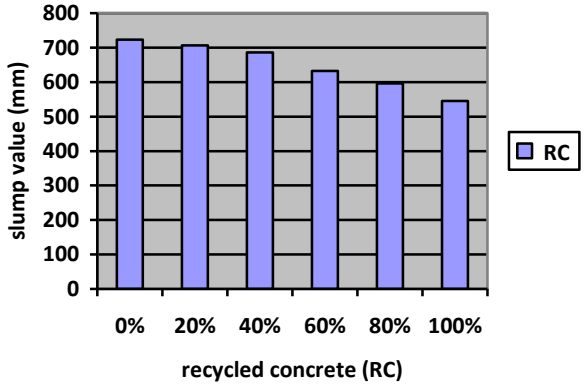

Figure 6: slump values of SCC with GC waste as 100% replacement with fine aggregate

b) **T_{500} test:**

Time taken by SCC to reach 500mm line is noted for all mixes of GC waste and RC. Comparison of values are plotted in the Fig.6

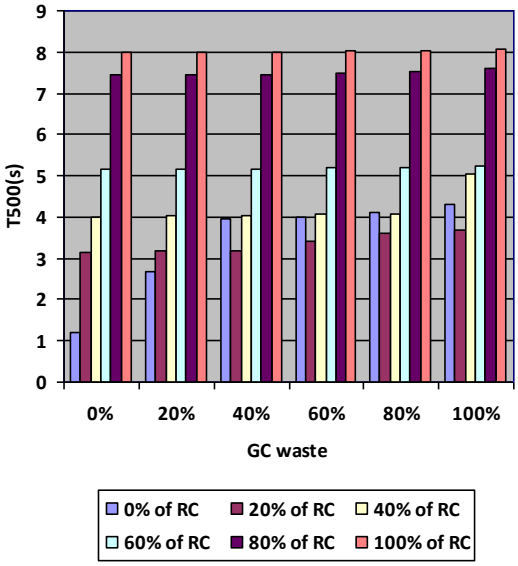

Figure 7: T_{500} values of SCC with combined effect of GC waste and RC.

c) **V-funnel time:**

V-funnel time test values of all mixes were plotted in the chart Fig.7.

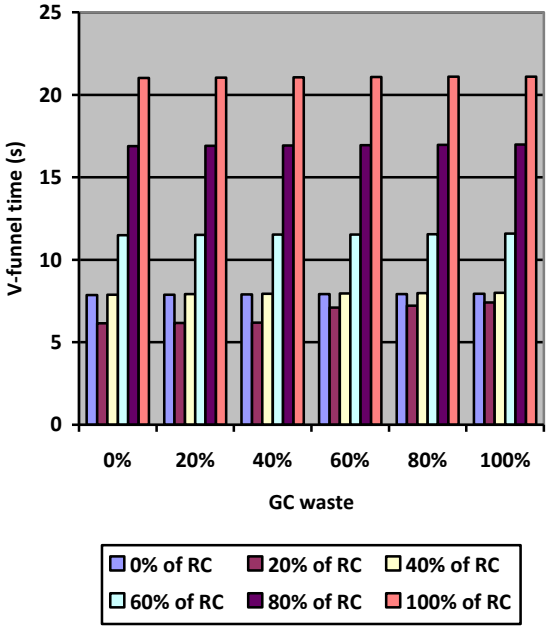

Figure 8: V-funnel test of SCC with combined effect of GC waste and RC

d) **L-box test:**

L-box height ratio of all mixes were shown in the Fig:8

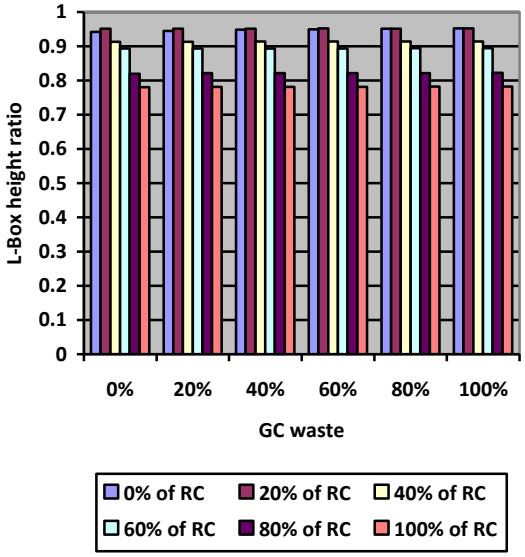

Figure 9: L-Box height ratio for SCC

e) **Compressive strength test:**

Cubes are casted to find out the compressive strength for 7 and 28 days. Comparison graphs for compression strength are shown in plot below

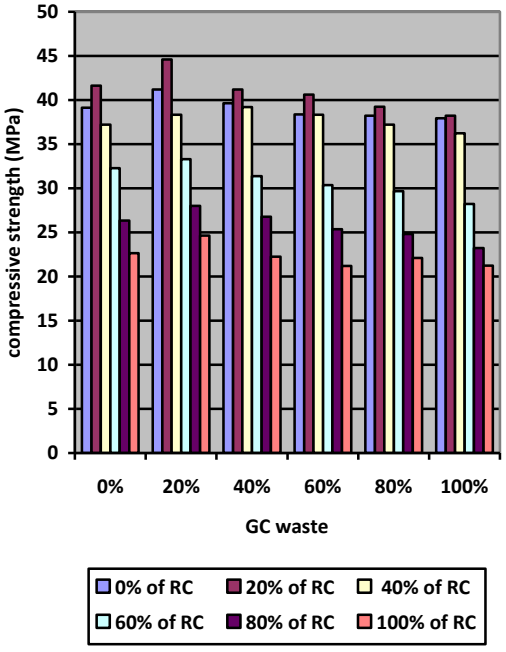

Figure 10: compressive strength of SCC at 7 days

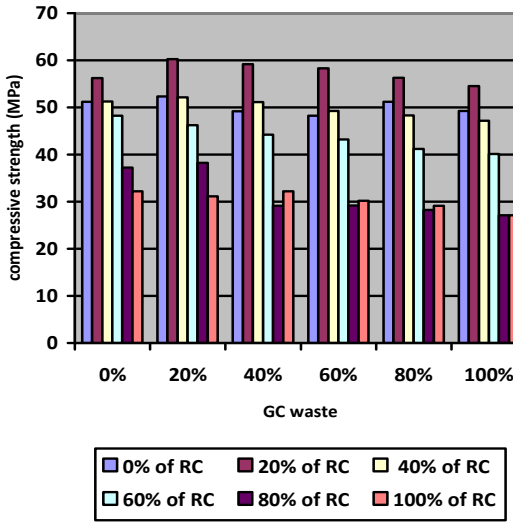

Figure 11 : compressive strength of SCC at 28days

f) Flexural strength :

Flexural strength values of SCC with GC waste and RC are calculated by casting beams. Comparison of different proportions of GC waste and RC are plotted below

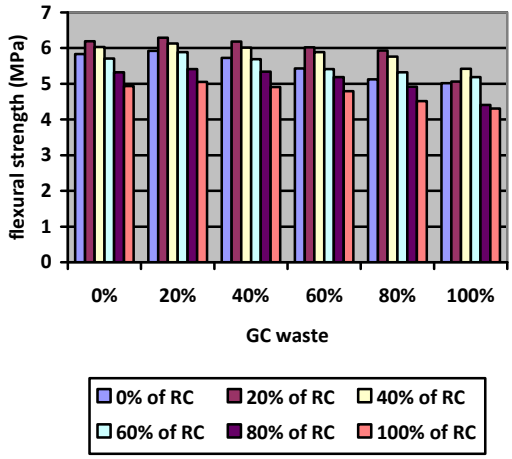

Figure 12: flexural strength of SCC at 28 days

V. CONCLUSIONS

From the test results, following conclusions can be declared

- As the GC waste and RC values are increasing, Slump flow values are gradually decreasing. The reason behind this must be increasing viscosity and may be non bonding behavior of recycled concrete and granite cutting waste
- T_{500} value, v-funnel and L-box values have the same behavior of slump flow, for the above stated reasons.
- Compressive strength values are increasing up to 20% and gradually decreasing for the next proportions. This may be due to irregular distribution of RC and also due to bonding characteristics of GC and RC.
- Flexural strength values shown good up to 20% and after 20% strength gradually decreased. The reason for flexural strength behavior is as same as for compressive strength.
- From the results, SCC is behaving good at 20% composition of both GC waste and RC.

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