Utilization of Granite Cutting Waste in Concrete

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Dimensional stones production figures for Rajasthan during 2005-2014 are as follows

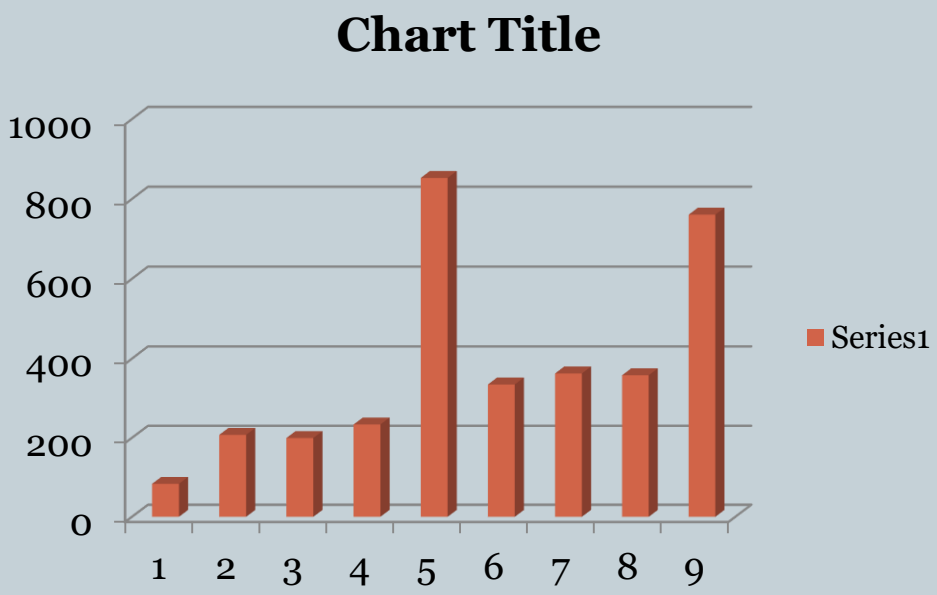
Stone Type	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Granite	852.62	335.09	362.69	358.21	760.59	759.62	1077.03	2849.52	983.23
Limestone (Dim.)	3748.39	4306.85	7268.28	5486.41	5523.92	6917.53	6449.32	5237.30	1862.25
Marble & Serpentine	8585.13	7642.74	8753.58	9569.91	11771.27	11469.89	14402.82	15384.31	14627.26
Slate & Quartzite	6.17	4.53	4.18	8.03	23.6	19.29	30.19	32.23	18.43
Sandstone	7019.15	7807.07	8695.2	10467.1	13846.52	11729.6	14130.14	16380.96	32513.29
Total	**20211.46**	**20096.28**	**25083.93**	**25889.66**	**31925.9**	**30895.93**	**36089.5**	**39884.32**	**50004.46**

Source: DMG, Rajasthan

(Production in Thousand tones)

Strength and Durability Studies on Concrete Containing Granite Cutting Waste as Partial Replacement of Sand

Graphical representation of Granite Production (in thousand tons)
source: DMG Report 2011



- Granite reserves in Rajasthan are estimated at 8479 million cubic metres and are spread over in the districts of Barmer, Jalore, Pali, Sirohi, Alwar, Jaipur, Jhunjhunu, Tonk, Ajmer, Bhilwara, Sikar and Udaipur.
- Prominent cluster of granite processing and quarrying in Rajasthan is Jalore with hundreds of single/ multiblade cutters and tiling plants. The quarries in Jalore, Barmer and Jaisalmer produce a wide variety of stones of excellent quality and colours.

Stone industry generates a lot of waste both at the mining and the processing stage.

Stone waste generated	% out of total
1. Quarrying (ungraded or undersized material, overburden, side burden & interburden)	50.00
2. Processing (Dressing, cutting and polishing)	15.00
3. Transportation	0.500
Total waste	**65.50**

Waste generation in stone industry (Source: DMG (Raj.) Report, 2011)

स्लरी से बढ़ रहा संकट

Source – Rajasthan Patrika feb 2013 , jalore

Problems with RCC structures

corossion

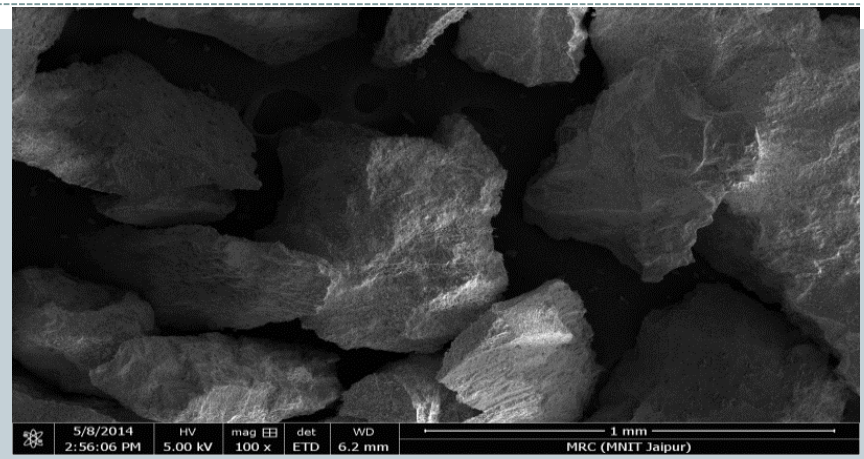
Corossion of Beams

Corrosion of columns

Objectives

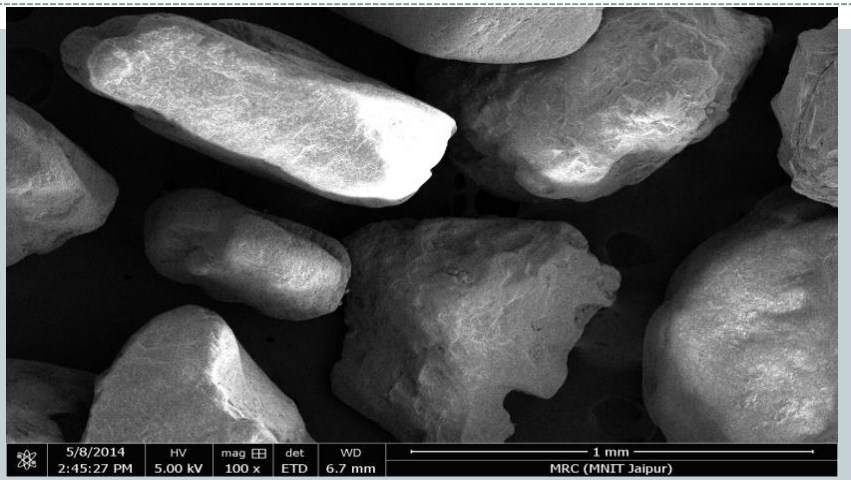
- **Physical** and **Chemical characterization** of Granite Powder.
- To study **Strength** and **durability** properties of concrete mixes containing granite powder.
- To study change in **micro structure, porosity** of concrete mixes with addition of granite powder.
- To study suitability of concrete paver blocks, bricks prepared using granite powder.

SEM Micrographs and EDS



El	C norm. [wt.%]	C Compound	[wt.%]
O	48.57		
Si	33.92	SiO2	72.57
Al	6.19	Al2O3	15.63
K	4.20	K2O	6.76
Na	2.34	Na2O	4.21
Mg	0.37	MgO	0.83
Total:	100.00		100.00

(a) Granite



El	C norm.	C Compound	[wt.%]
O	65.03		0.00
Si	39.60	SiO2	84.73
Al	5.64	Al2O3	10.66
K	2.72	K2O	3.28
Mg	0.80	MgO	1.33
Total:	100.00		100.00

(b) Sand

Scope of Study

- This study will help in obtaining an optimum replacement percentage of sand by Granite slurry dust.
- The use of waste stone slurry powder in concrete opens new avenues to further study in the area of alternative uses for granite waste.
- On one hand the extensive use of waste granite slurry dust in concrete will reduce the cost of concrete as use of sand would come down

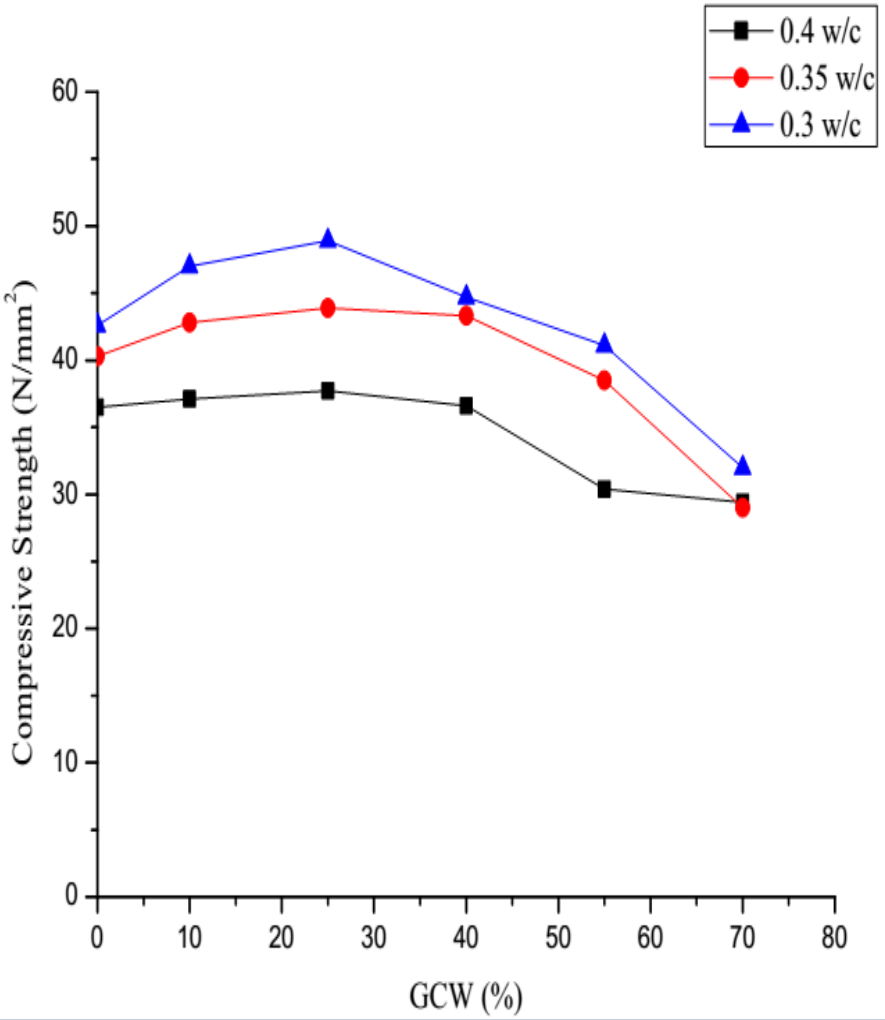
List of test and Specimen size

S.No	Test	Size of specimen	No. of specimens
1	Compressive strength	15 cm x 15 cm x 15 cm	9 (Nine)
2	Flexural strength	50 cm x 10 cm x 10 cm	9 (Nine)
3	Abrasion Test	10 cm x 10 cm x 10 cm	3 (Three)
4	Carbonation	10 cm x 10 cm x 10 cm	3 (Three)
5	Sorptivity Test	10 cm x 10 cm x 10 cm	3 (Three)
6	Permeability DIN	15 cm x 15 cm x 15 cm	3 (Three)
7	Chloride Diffusion	15 cm x 15 cm x 15 cm	1 (One)
8	Sulphate Attack	10 cm x 10 cm x 10 cm	3 (Three)
9	Shrinkage	30 cm x 7.5 cm x 7.5 cm	3 (Three)
11	Corrosion	Mould Size	1 (One)
12	Pull off	Used Beam	
13	Acid Attack	10 cm x 10 cm x 10 cm	3 (Three)

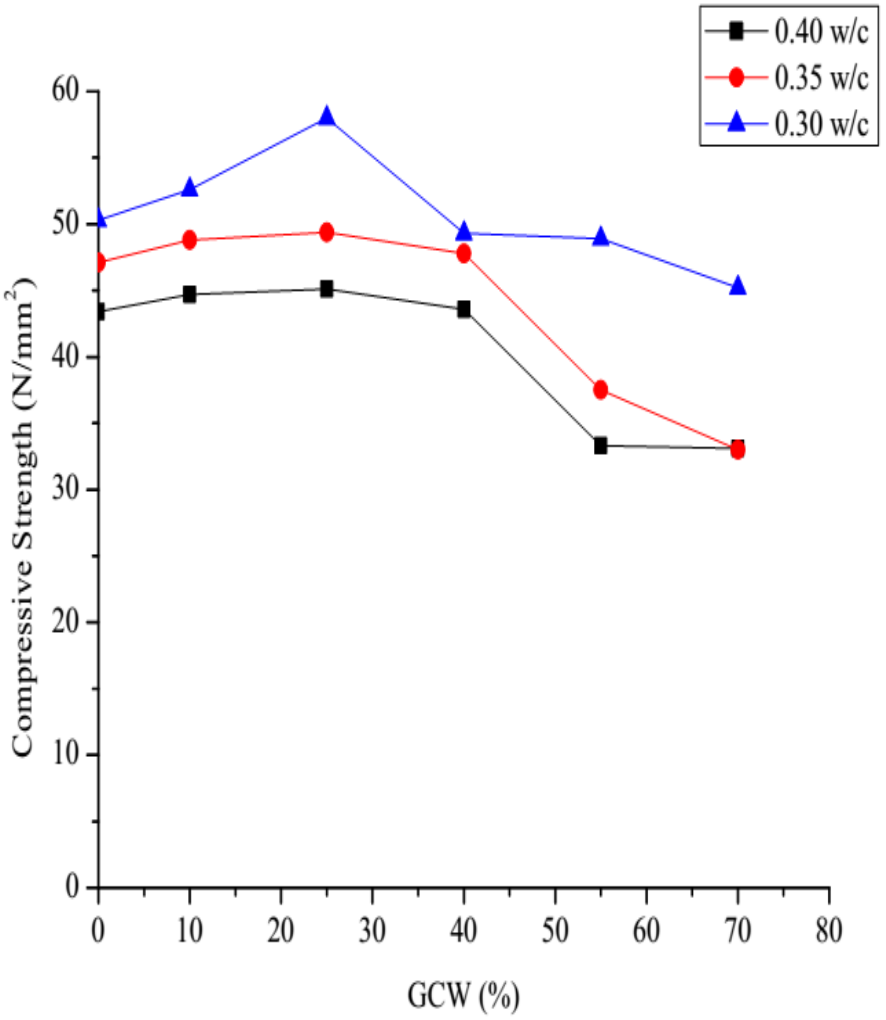
Casting Beams

Casting Cubes

Compressive Strength

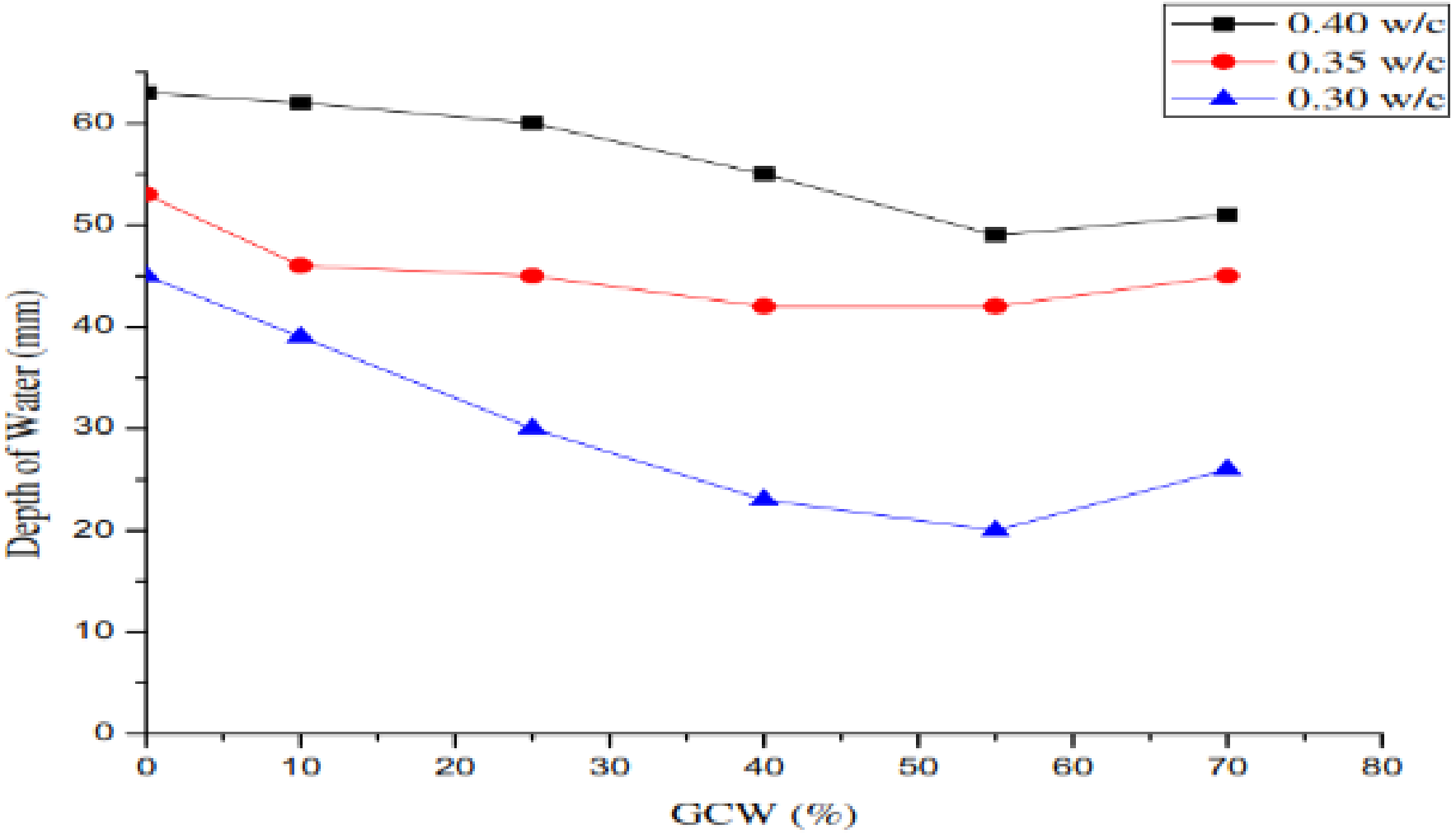


7 Days Strength

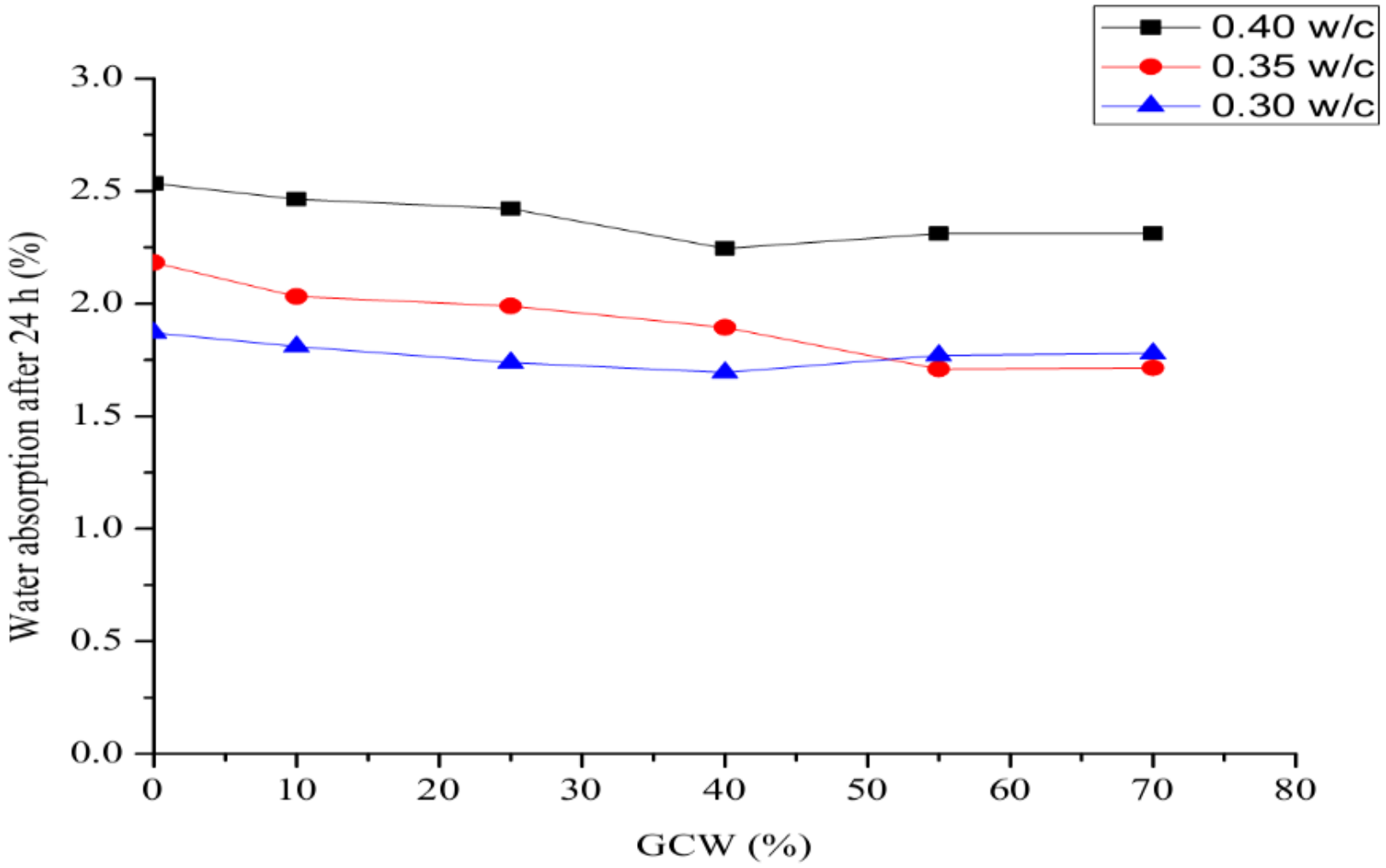


28 Days Strength

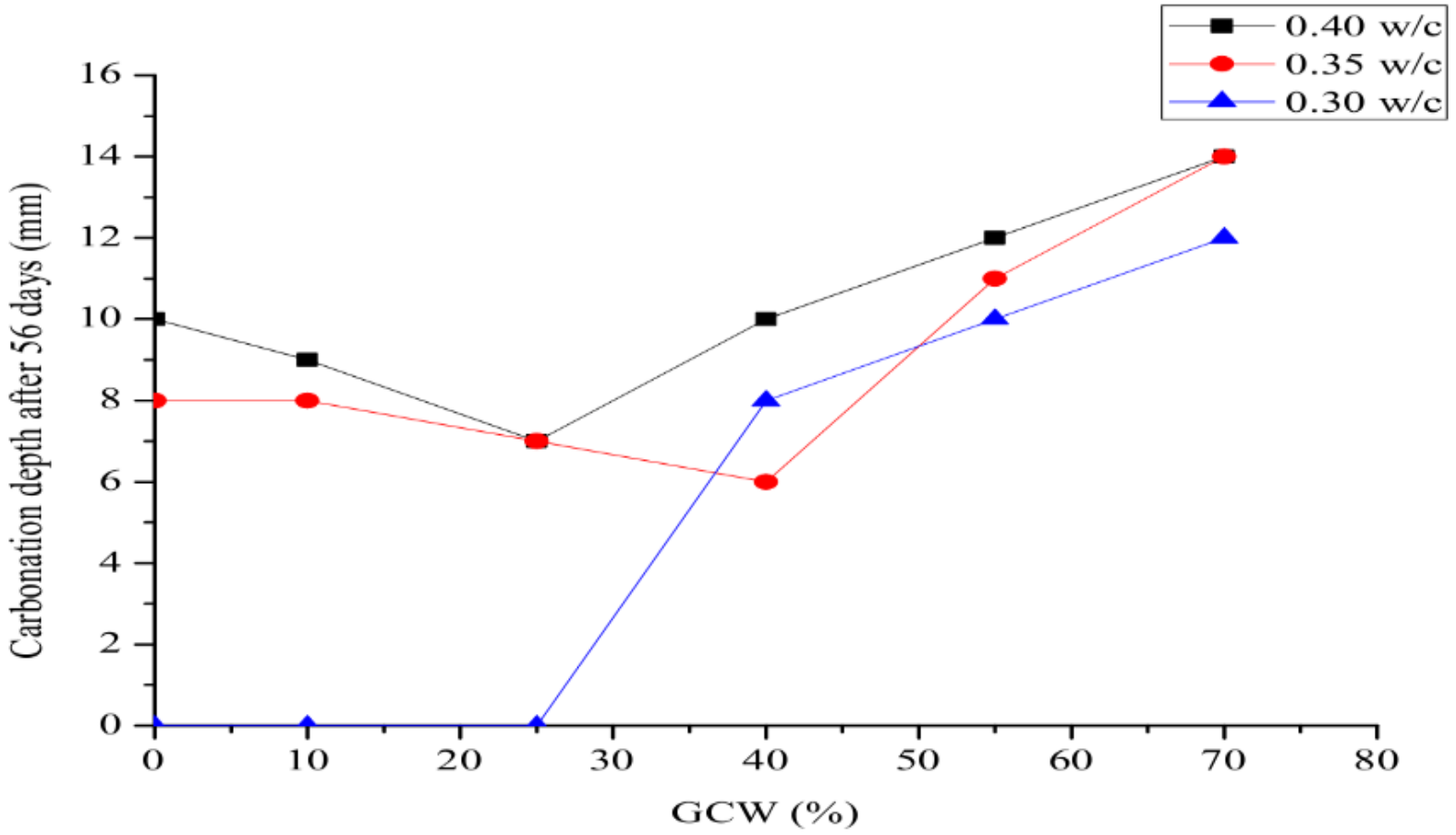
Permeability



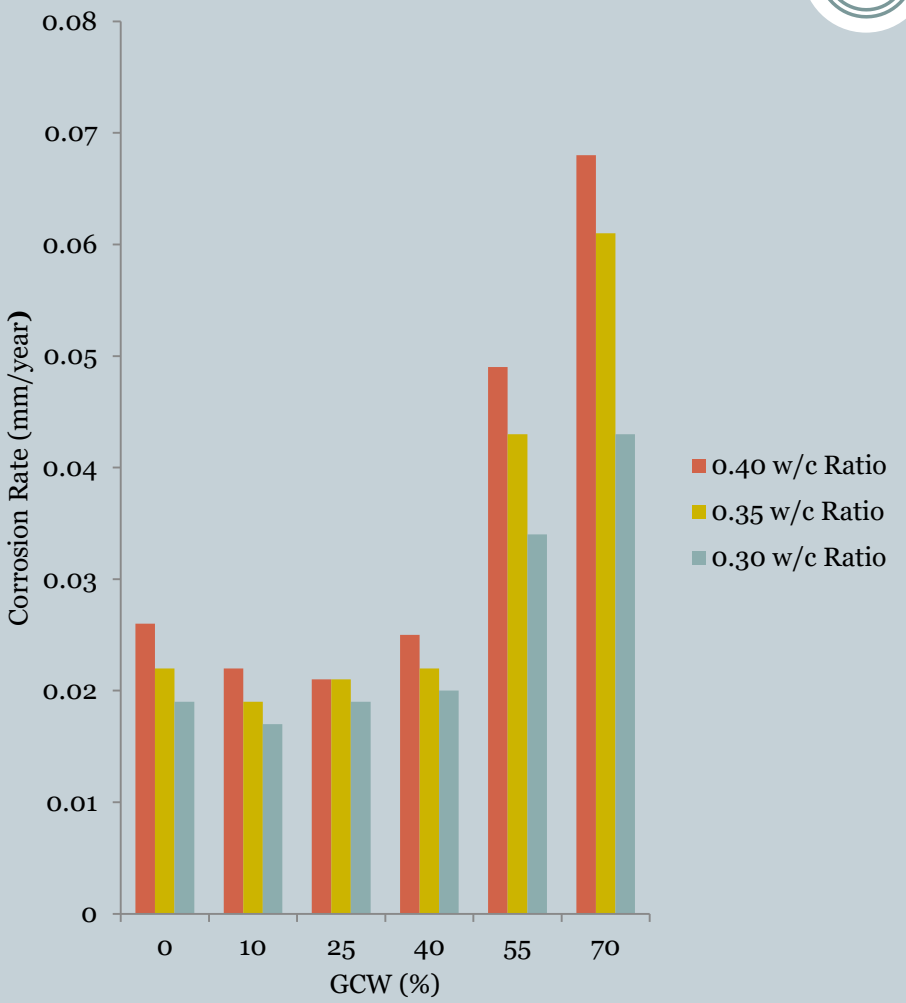
Water Absorption



Carbonation



Corosion Rate of steel bars



Broken corrosion specimen for visual examination

Conclusion

About 25-30 % replacement of River Sand by Granite Cutting Waste in Concrete increases

1. Strength
2. Durability

Important additional Constituents Of SCC

Fly ash:

In appropriate quantity may be the added the quality

Silica fumes:

Added to improve the mechanical properties of SCC.

Stone powder:

granite added to increase the powder content.

(400-450 Kg Cement + 150-200 Kg granite Slurry)

Fibres:

fibres may be used to enhance the properties of SCC as same as normal concrete

GCW SUBSTITUTED HOLLOW CONCRETE BLOCKS AS AN INNOVATIVE TURNKEY SOLUTION FOR SUSTAINABLE CONSTRUCTION

Conclusion

The compressive strength and flexural strength results showed that granite slurry can be can successfully replace crushed rock fines (CRF)/Sand in the production of concrete hollow blocks. The study was confined to replacement up to 30%, but gradual increase in strength results indicates that further replacement may also be successful.

Blocks

Blocks

Pavers

CDOS RESEARCH CHAIR
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&
15 PhD and M.Tech students of MNIT

Achievments

7 phd awarded, 62 research papers in reputed international journals and 7 patents filed

Thanks

FOR FURTHER ENQUIRIES AND TO SHARE NEW IDEAS AND RESEARCH INTEREST PLEASE CONTACT

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