



Graphene Oxide Reinforced Sustainable Geopolymer Concrete

Submitted By:-

Dr Pardeep Kumar, Associate Professor,
Civil Engineering Department,
NIT Hamirpur, Hamirpur (H.P.)

Presented by:-

Bavita Bhardwaj, Research Scholar

Department of Civil Engineering

National Institute of Technology, Hamirpur, HP, India, 177005

Salient Features of Project

- ▶ Development of sustainable and eco friendly Geopolymer Concrete (GPC) by utilizing waste foundry sand (WFS) as replacement of natural sand and coarse recycled concrete aggregates (RCA) as replacement of coarse natural aggregates
- ▶ Enhancement of fracture properties of Geopolymer concrete by incorporating Graphene oxide (GO), carbon based nano material
- ▶ Study the effectiveness of retrofitting using GPC

Research Significance

- ▶ Utilization of waste materials such as WFS and RCA in GPC will lessen the burden on environment and will solve the problem of waste disposal.
- ▶ Limited research has been done on the use of WFS in concrete. Moreover, negligible research has been found on the use of WFS in GPC.
- ▶ Addition of Graphene oxide (GO) in concrete is expected to enhance fracture toughness of GPC and may also help in recovering the loss in strength of concrete due to incorporation of WFS and RCA.



Objectives

1. To develop Geopolymer concrete with foundry sand and RCA.
2. To develop Geopolymer concrete with foundry sand and RCA by incorporating Graphene Oxide.
3. To study strength and durability properties of concrete in fresh and hardened state.
4. To check the efficacy of geopolymer concrete developed in retrofitting of columns.

Expected Outcomes

- ▶ Sustainable concrete is expected to be developed as WFS and RCA are used in high replacement ratio to prepare an environment friendly and durable composite.
- ▶ Inclusion of fine materials i.e. WFS and GO in GPC are expected to enhance its mechanical performance and reduce the permeability by filling the pores of the composite material.
- ▶ Graphene oxide has been reported to improve the fracture properties of ceramic and polymeric composites due to its superior physical and chemical properties hence improvement in the fracture properties of GPC developed in this research is expected.



Cost Analysis of Particulars Required

Particulars required

S.no.	Particular	Quantity	Cost (in Rupees)
1	Materials		
1(a)	OPC 43 Grade, Fly Ash (Class F), Foundry Sand, Natural sand, Coarse Natural Aggregates, 12.5 mm nominal size, RCA, 12.5 mm nominal size, Recycled Concrete Aggregates, etc.	Lump Sum	50,000 (LS)
1(b)	Superplasticizer	200 litres	75,000
1(c)	Sodium Hydroxide pellets	150kg	63,000
1(d)	Sodium Silicate solution	350kg	75,000
1(e)	Graphene Oxide	2kg	50,000
Total Cost (for materials)			3,13,000

Particulars required

S.no.	Particular	Quantity	Cost (in Rupees)
2	Labour charges (Two daily wage laborer for period of one year)	2	1,50,000
3	Contingency and other costs, stationary, Literature, transportation charges, attending workshops and conferences, boarding and lodging charges etc.	Lump Sum	2,00,000
4	Testing charges for microscopic study (SEM, XRD etc.)	-	#1,00,000
5	Intellectual fee to Principal Investigator (for 16 months)	@ Rs. 10,000/ PM	1,60,000
Total (in Rupees)			9,23,000
Institutional overhead @ 15%			1,38,450
GRAND TOTAL COST (in Rupees)			10,61,450

Total Project Cost: Ten Lac Sixty One Thousand Four Hundred and Fifty only.

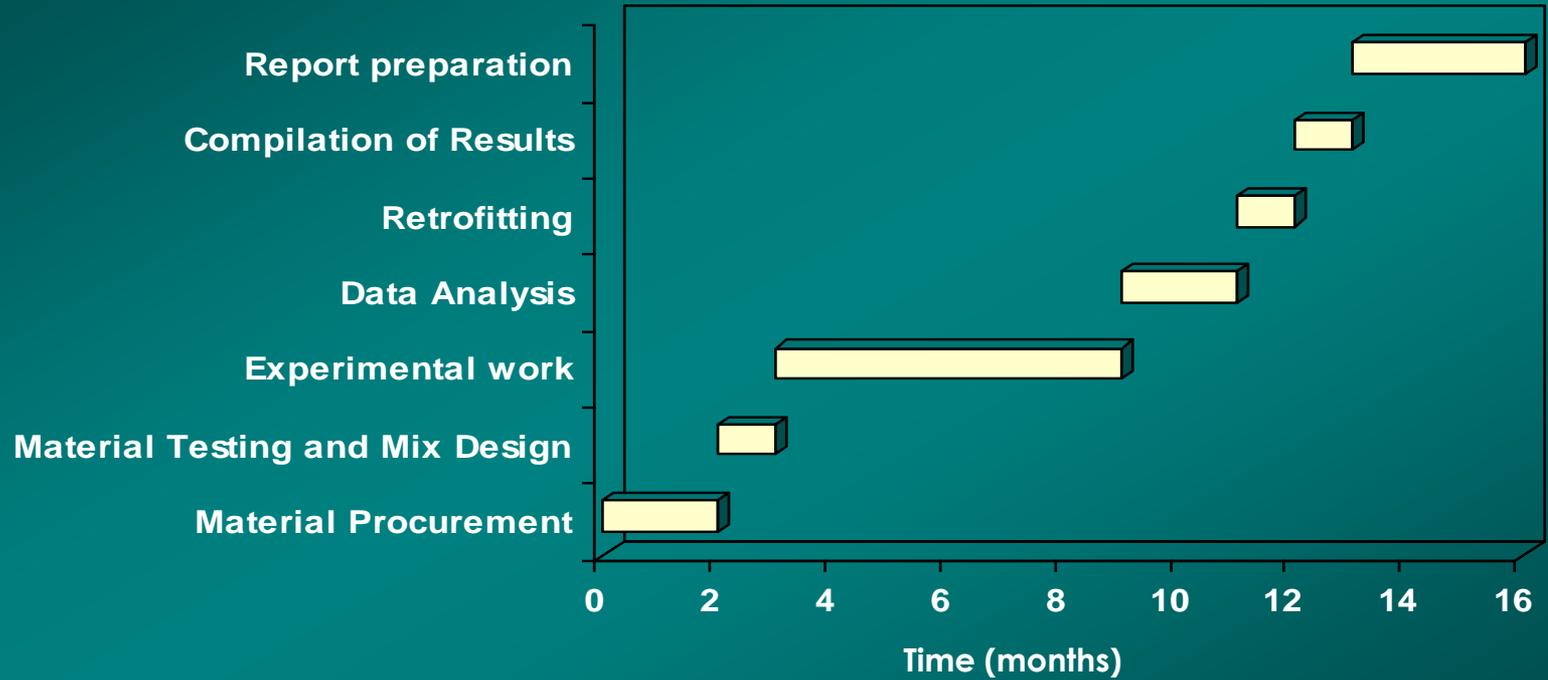
Testing charges have been reduced to Rs 1.0 Lac from Rs 3.0 Lac because one of the instruments is being purchased by NIT Hamirpur itself, earlier the testing of which was proposed to conduct in some other institute by paying testing charges including TA&DA (Rs 2.0 Lac)

Testing- Testing age and specimen size

Test	Specimen Size (mm)	Testing Ages (Days)	No. of specimens for each testing age	Total specimens
Compressive Strength Test	100x100x100 size cubes	28, 56, 90	3	9
Flexural Strength Test	100x100x500 size beams	28, 56, 90	3	9
#RCPT	100 dia x 200 height	56, 90	3	6
Total (each batch)				24
Total (29 mixes)				696

Earlier due to unavailability of RCPT equipment at NIT Hamirpur it was proposed to conduct this testing at some other institute for which testing charges were demanded (for approx. 174 samples)

Work Plan





THANK YOU