

Case Study on Multistorey Building In Different Types of Soil

Mr.Arpit Gupta

Assistant Professor

Civil Engineering Department,

K J INSTITUTE OF ENGINEERING & TECHNOLOGY, SAVLI, VADODARA, GUJRAT

ABSTRACT

The design process for structural design is not a imagination, but also knowledge of science of structural engineering such as recent design code, by laws, experience and judgement. We have know that the properties of soil and its behavior is different at different places. so, we cannot built the same structure at different soil. so, we have collected data and analysis the soil properties and determine its safe bearing capacity at different soil. In this case the use of FRP material for efficient and easy work construction of multi-storey building. to develop light weight building having a long life.

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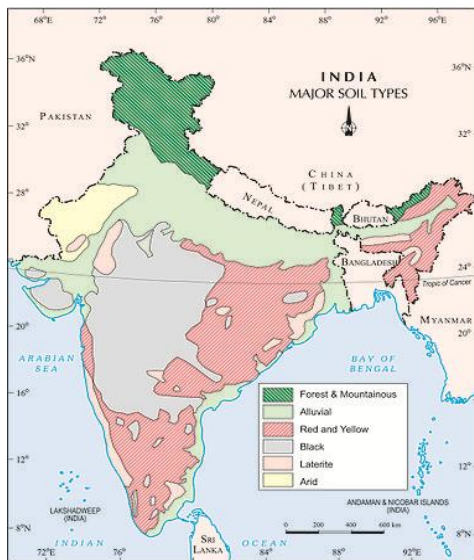
I. INTRODUCTION

Construction projects are mainly depends upon the surrounding area of construction and type of soil on which project has to be carried out. construction on black cotton soil or expansive soil is quite difficult, lengthy and costlier as compared to construction on normal soil. The bearing capacity, stability of soil, consolidation, compression, shear strength plays an important role in construction of any building. During the excavation for footing the soil gets disturbed and losses its stability, bearing strength and shear strength. For overcoming these problems in earlier time the soil stabilizers are added to soil and for improving the SBC of soil. The boulders are mixed with the soil and other chemicals are used under the soil. In india different type of soil like black cotton soil, red soil, yellow soil, etc. to construct the building in different types of soil.

II. CURRENT SCENARIO AND METHODS

Phase I: Soil classification In india

- When the **Soil survey of India** was established in **1956**, they studied soils of India and their characteristics.
- **The National Bureau of Soil Survey** an institute under the control of Indian Council of Agriculture Research did a lot of studies on Indian soil.



TYPES OF SOIL

1. Alluvial soil (43%)	2. Red soil (18.5%)
3. Black / regular soil (15%)	4. Arid / desert soil
5. Laterite soil	6. Saline soil
7. Peaty / marshy soil	8. Forest soil
9. Sub-mountain soil	10. Snowfields

Phase II: Special Material use in soil properties

FIBRE-REINFORCED PLASTIC (FRP).

- **Fibre-reinforced plastic (FRP)** is a composite material made of a polymer matrix reinforced with fibers.
- The fibre are usually glass carbon. rarely, other fibres such as paper, wood have been used.
- Specifying the orientation of reinforcing fibres can increase the strength and resistance to deformation of the polymer.
- FRP is also call fibre reinforced polymer.
- FRP is also improve the soil bearing capacity.



CONSTITUTION AND GENERAL PROPERTIES OF FRPS

Fibre Reinforced Polymer (FRP) materials - 2 phases:

1. Fibre reinforcement
 - a. High resistance
 - b. Brittle behaviour
2. Polymeric matrix (resin + filler + additives)
 - a. Very low resistance
 - b. Load transfer and stress distribution between fibres
 - c. Protection of fibres from environmental agents
 - d. Keeping the fibres in position (and preventing their buckling when compressed)
 - e.

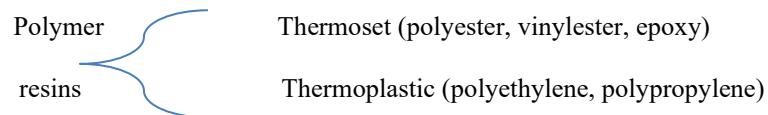
CONSTITUTION AND GENERAL PROPERTIES OF FRPS

Properties and forms of reinforcing fibres

Property	E-GLASS	CARBON	ARAMID
Strength [MPa]	2350 - 4600	2600 - 3600	2800 - 4100
Elasticity modulus [GPa]	73 - 88	200 - 400	70 - 190
Strain at failure [%]	2.5 - 4.5	0.6 - 1.5	2.0 - 4.0
Density [g/cm ³]	2.6	1.7 - 1.9	1.4

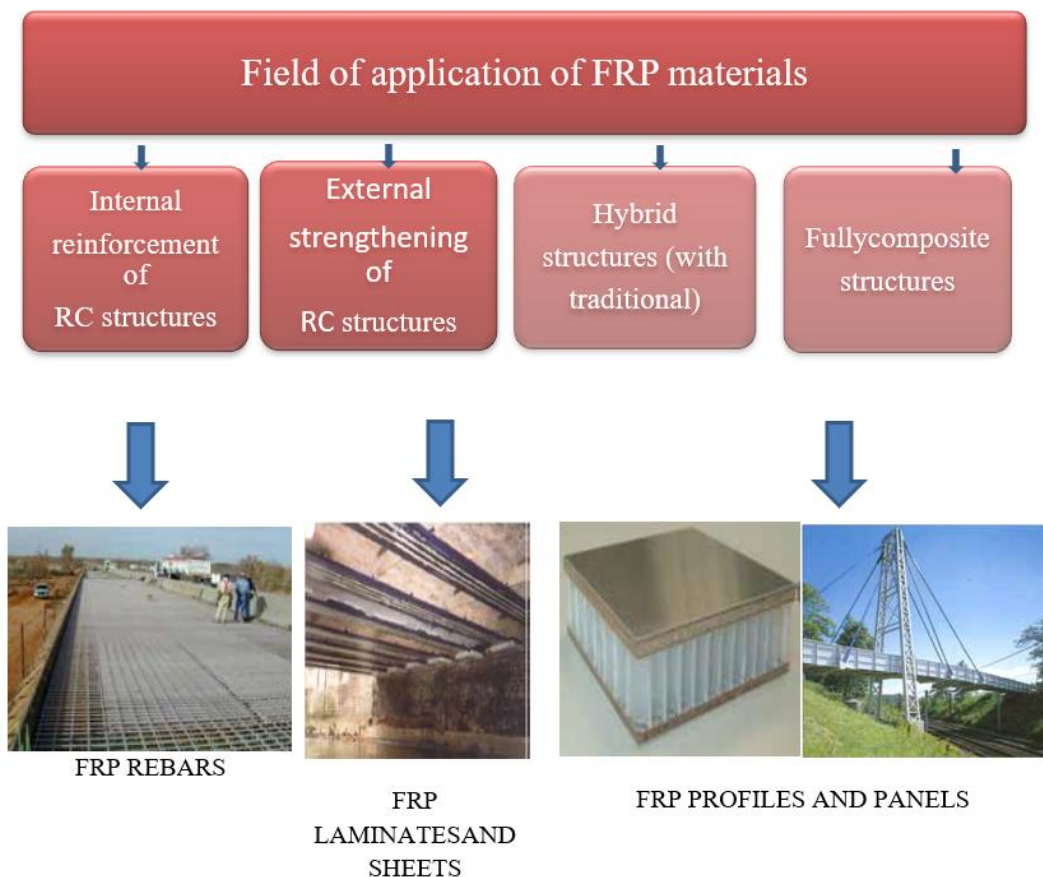
CONSTITUTION AND GENERAL PROPERTIES OF FRPS

Properties of polymeric matrixes



Property	Polyester	Vinylester	Epoxy
Strength [MPa]	20 - 70	68 - 82	60 - 80
Elasticity modulus [GPa]	2 - 3	3.5	2 - 4
Strain at failure [%]	1 - 5	3 - 4	1 - 8
Density [g/cm ³]	1.2 - 1.3	1.12 - 1.16	1.2 - 1.3
Glass transition temperature [°C]	70 - 120	102 - 150	100 - 270

STRUCTURAL APPLICATION OF FRP MATERIALS



Phase III: SOIL TEST IN BLACK COTTON SOIL

1. STANDARD PROCTOR TEST

❖ These laboratory tests generally consist of compacting soil at known moisture content into a cylindrical mold of standard dimensions using a compactive effort of controlled magnitude. The soil is usually compacted into the mold to a certain amount of equal layers, each receiving a number of blows from a standard weighted hammer at a specified height. The graphical relationship of the dry density to moisture content is then plotted to establish the compaction curve. The maximum dry density is finally obtained from the peak point of the compaction curve and its corresponding moisture content, also known as the optimal moisture content.



2. PENETRATION TEST

❖ The main purpose of the test is to provide an indication of the relative density of granular deposits, such as sands from which it is virtually impossible to obtain undisturbed samples. The soil strength parameters which can be inferred are approximate, but may give a useful guide in ground conditions where it may not be possible to obtain borehole samples of adequate quality like gravels, sands, silts, clay containing sand or gravel and weak rock. In conditions where the quality of the undisturbed sample is suspect.



3. INITIAL-FINAL TEST

❖ Initial setting time is that time period between the time water is added to cement and lime which 1mm square section needle fails to penetrate the cement paste, placed in the vicat's mould 5mm to 7mm from the bottom of mould. Final setting time is that time period between the time water is added to cement and lime at which 1mm needle makes an impression on the paste in the mould but 5mm attachment does not make any impression.



4.TRI-AXIAL TEST

❖ The purpose of the triaxial test is to determine the shear strength and the deformation behaviour of the soil. horizontal pressure is exerted on all sides of the soil sample by applying pressure to the water around sample.



Phase IV: SOIL TEST RESULT ANALYSIS

	BLACK COTTON SOIL(CH)	YELLOW SOIL (CL)	RED SOIL (SM)
LIQUID LIMIT	63 to 68%	30 to 33%	23 to 26%
PLASTICITY INDEX	26 to 29%	12 to 15%	No
COHENSION	0.53	0.23 to 0.26	0
FRICTION ANGLE	0	18 to 19%	27 TO 29
G	2	7 to 9%	5 TO 12
M&C	83	63 to 70%	23 TO 30
S	100-G-M&C	100-G-M&C	100-G-M&C
MDD	1.658 to 1.695 gm/cc	1.78 to 1.83 gm/cc	1.9 TO 2.01 gm/cc
OMC	18.7 to 20%	14 to 16%	10 to 12%
SPECIFIC GRAVITY	2.57 to 2.58	2.59 to 2.61	2.63 to 2.65
Fs	65 to 75%	33 to 38%	20 to 25%

III. CONCLUSION

In this case study the properties of soil & its behavior can change using the special materials & construct high rise building on black cotton soil. The use of FRP material for efficient and easy work construction of multi-storey building to develop light weight building having a long life.

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Mr. Arpit.S. Gupta
Assistant Professor
Civil Engineering Department,
K J INSTITUTE OF ENGINEERING & TECHNOLOGY, SAVLI,
VADODARA, GUJRAT
Email id – arpit.gupta@kjit.org