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Comparative Study of Conventional and GFRG Building for Affordable Construction

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Abstract - *In India, Economically Weaker section group of people miss, have no opportunity of owning a home like Stronger section group of people. In this Technology world were using smart building materials for building construction purpose. The cost is reaching sky-high and the current mode of construction adopted Reinforced Cement Concrete (RCC) construction, which is time consuming, costly and not environmentally friendly calls for the use of smart construction materials. One such material Glass Fiber Reinforced Gypsum (GFRG) Panels is adopted. This material is manufactured in a close environment and perform better when compared to RCC in many factors denotes which method is more suitable for today's changing world . The study consisted of comparison of Drawings using AUTO CAD, Exterior design using SKETCH UP, Load analysis using STADD PRO , Estimation using MS EXCEL , Scheduling using MS PROJECT between the conventional RCC construction and GFRG construction. It requires innovative, energy efficient, strong and durable in fast method construction at economical cost.*

Key Words: Reinforced Cement Concrete, Glass Fiber Reinforced Gypsum, Drawings, AUTO CAD, Design, SKETCH UP, Analysis, STAAD PRO, Estimation, MS Excel, Scheduling, MS Project.

1.INTRODUCTION

Primary need of human being in today's world is food, clothing and shelter. House construction is a dream for low-income people in India. Whether he is a farmer, labour or private employee, cost of construction is high because of high wages and high material cost. A poor man has to spend hisentire life in construction of a house. Low-cost housing is reasonable for low-income owners, if they can invest 30% of their household income. India as a developing country, has 20% of high-income population that can afford a house High- and middle-income people takeover most of the lowincome housing. There is a necessity of cost-efficient construction technology and construction materials. A lowcost housing doesn't mean to sacrifice the strength or build with operational materials but it means effective use of local materials and techniques that are durable and require less maintenance. Low-cost material reduces the cost by using alternative techniques. In India, there is a huge requirement for building materials due to the existing housing shortage mainly in urban India and till date, it takes a lifetime worth of savings to buy a house. To overcome this problem, India needs innovative, high efficient building materials for strong and durable housing at an affordable cost. GFRG Panel provides fast construction and provides environmental protection. A lot of efforts had been made earlier by the industry experts to find an alternative method to existing construction technology to make it more affordable and innovative. Glass Fibre Reinforced Gypsum (GFRG) is one of the such technologies in the construction field that could reduce the construction cost .and construction period. In this project we are comparing GFRG building with conventional RCC building.We design a house plan using AutoCAD, Exterior design using Sketch up Software, analyse the building using staad pro for both RCC and GFRG building. Then we compare the results of RCC and GFRG Building and conclude which is best.

2.LITERATURE REVIEW

Pranay Thergaonkar , Mohit Nagpal et al. (2018) There is a rapid increase in the requirement of building materials in India due to the existing condition of transformation from temporary housing to a permanent housing causing shortage of housing material. Construction industry was still using traditional methods, techniques and conventional technologies. Low-cost and affordable housing is a better way to provide the shelter to the lower middle class and poor families which can be reached through the use of proper techniques. To achieve effective and affordable construction, a material known as GFRG (Glassfiber reinforced gypsum) has been studied. Glass fiber reinforced gypsum (GFRG) wall panel consist of gypsum in its plaster form and glass fibres which are bonded together. This panels have hollow cavity from inside and so can be used as load bearing walls. The hollow cavity inside the walls is filled with reinforced concrete based on the needs. There is various other material which can be used for affordable housing but in this study the main focus is kept on GFRG.

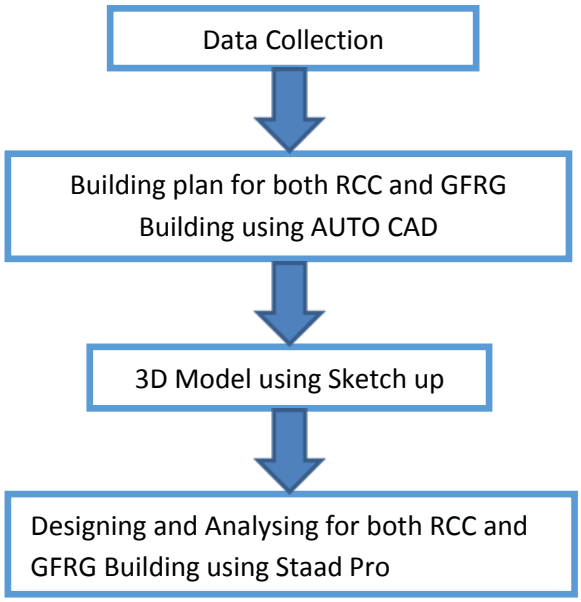
Pankaj Kumar (2021) There is a substantial growing demand for housing in India as thepopulation increase rate is skyrocketing. More and more people are shifting from rural to urban areas day by day, making urban areas denser. The Ministry of Rural Development assessed that India's rustic housing lack remains at 44 million dwelling units. To address the difficulties, India requires innovative, modern energy-effective construction materials for a reliable, quick, and tough housing strategy for development at a moderate expense. It is likewise significant that housing structures are catastrophes impervious to secure individuals' lives and properties. One strategy to accomplish that is to utilize Glass Fiber Reinforced Gypsum (GFRG) panels.They serve the purpose of fast construction and be cost-efficient, earthquake-resistant, bestsuitable for the financially Indian backward class of people and in the country's earthquake-prone regions like Gujarat. The phosphogypsum's effective disposal is achieved through the Glass Fiber Reinforced Gypsum (GFRG) panel, also known as Rapid wall. These can be used as load-bearing as well as non-loadbearing structures. To use GFRG in loadbearing buildings, M20grade concrete is used as a filling material to overcome the hurdlesprovided by gravity and other factors. M20 grade concrete is used in these panels to satisfythe minimum requirements mentioned in IS 456:2000.

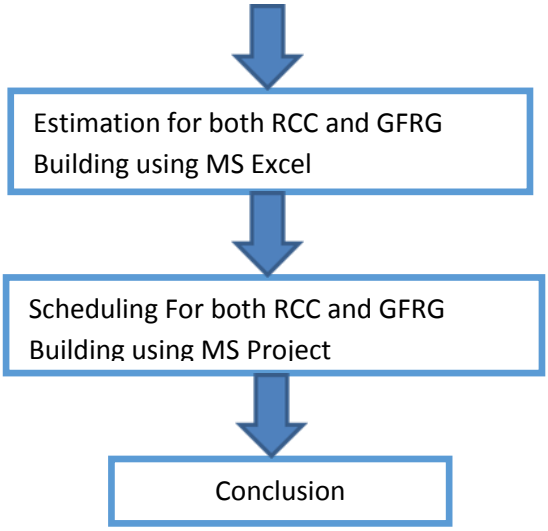
Salini S, D. Vimal et al. (2020) Even though the construction industry is one of the booming industries in the world which is measured as a sign of growth and development, one of the major setbacks is the time consumption involved in operation and progress of this industry. Many techniques and methodologies are adopted to overcome that hindrance,one of among that is GFRG panels. GFRG panels also known as rapid wall. This technology is widely used in construction of walls, roof and floor slabs in with or without in combination with concrete. This project is mainly consisted the study of Comparison between the conventional RC building construction technique and GFRG Construction. The analysis of the structures are carried out in E-Tabs software. From the results of analysis shear force, story drift, story displacement of the three structures is compared andresults are represented graphically to study their performance.

Snehal Ashok Salvi, Janhavi Deshpande, Vishal Jadhav, Nandini Pate, Vaishali Kamade, Aniruddha Chavan et al. (2021) This research paper is about costing and rate analysis of GFRG structure and conventional structure. Being an engineer is our first priority calling for solutions that work for our customers. This paper an effort made to give an idea of how we can do that reducing construction costs and reducing construction time uses predesign technology. GFRG construction technology also called as Rapid wall construction technology in India. Glass Fiber reinforced with gypsum panels, as they are ready-made gypsum building panels have cavities. It is used in commercial buildings, institutions and residential buildings. GFRG walls can be used as part of the structure such as walls and slabs, without outer columns and beams are required.

3.METHODOLOGY

With reference to the literatures, the plan and design parameters are identified from the literatures and experts' opinion. With this identified factor the data are collected for analyzing and design of G+1 RCC and GFRG panel building using Stadd pro, planning using AutoCAD and 3- Dimensional view using Sketch up. Finally comparing the results of both Glass Fiber Reinforced Gypsum and Reinforced cement concrete. The risk factors identified are to be analyzed by suitable qualitative risk analysis and a proper framework will be provided

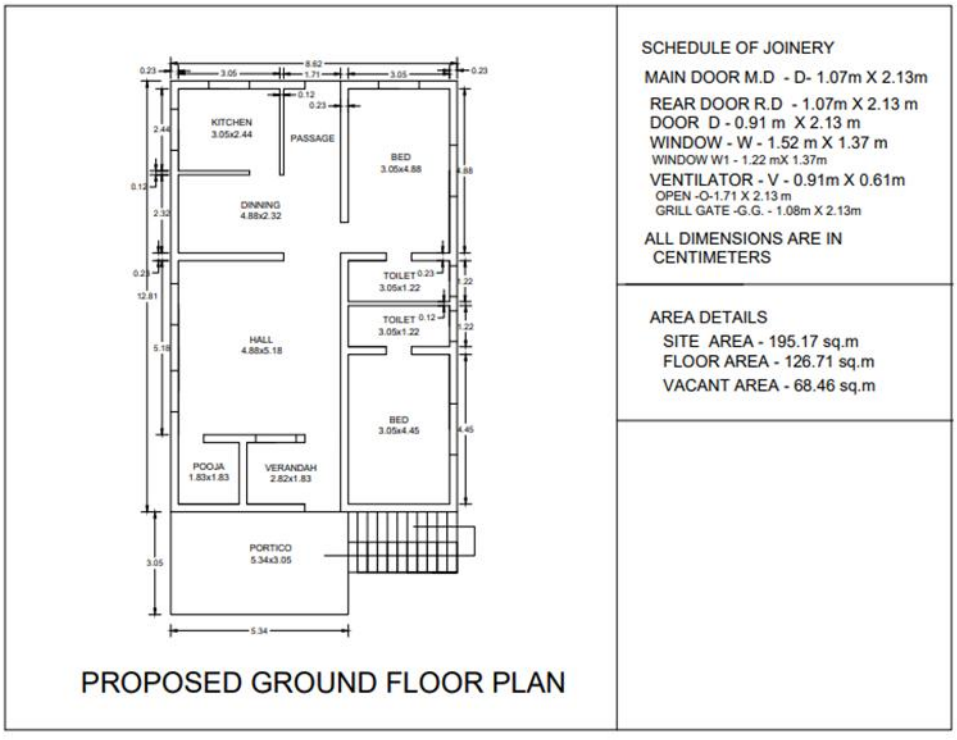


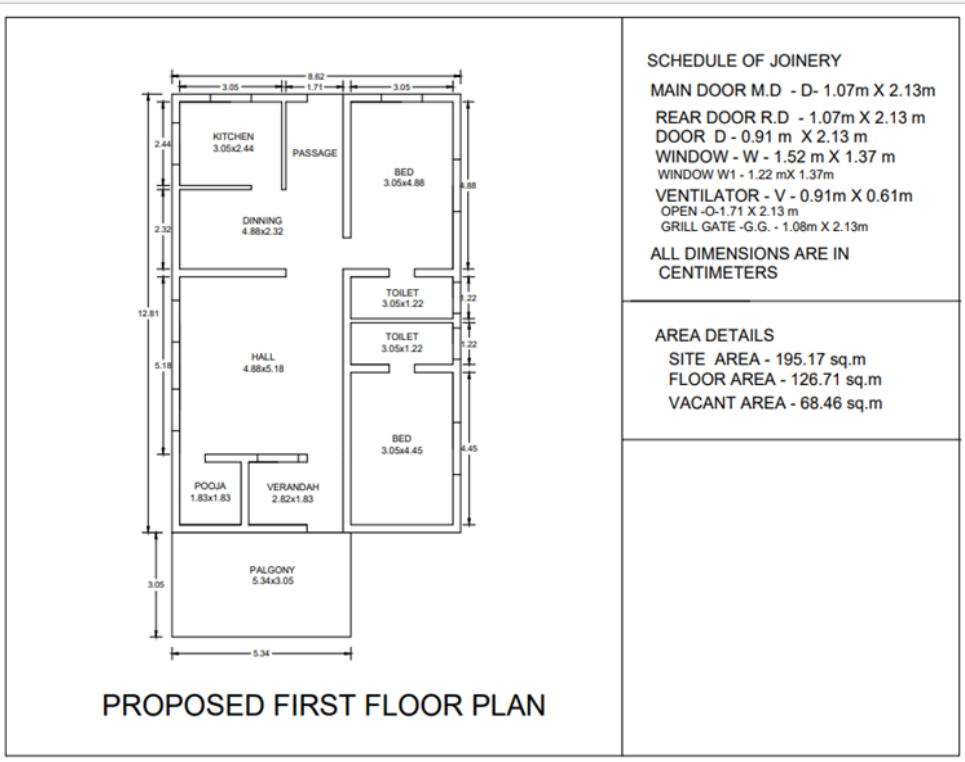


4.DATA COLLECTION

Data required for Construction of G+1 Residential Building The Site area is 195.17 sq.m. The Pro Ground Floor area is 126.71 sq.m. The Vacant Area is 68.46 sq.m .The building is facing South direction. The soil type is Loam.

5.BUILDING PLAN FOR RCC AND GFRG BUILDING USING AUTOCAD





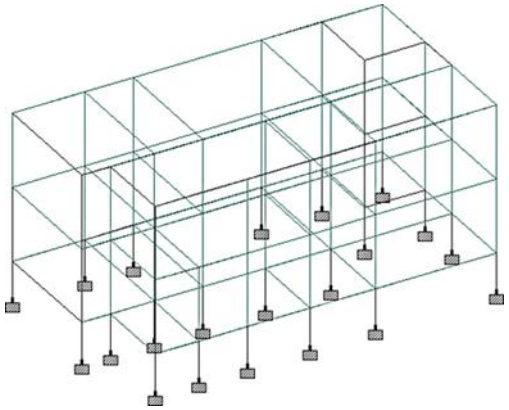
6.EXTERIOR DESIGN OF RCC AND GFRG BUILDING USING SKETCH UP

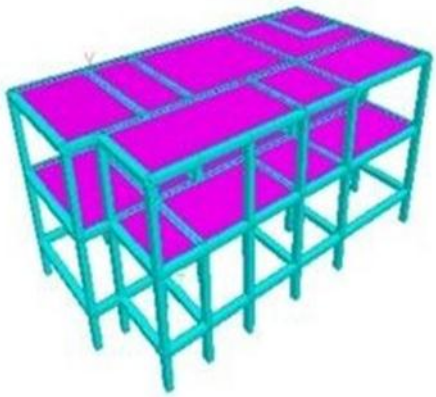
7.ANALYSIS OF RCC AND GFRG BUILDING USING STAAD PRO

7.1 Analysis of RCC Building using Staad Pro

The above Auto CAD plan is drawn in staad Pro for both RCC structure and the Results are notedand compared. The Model is created first and loads such as Dead load, Live load, and wind load is applied. The structure is checked for error and the report is generated. Bending moment diagram,bending moment, shear force etc. are generated. Beam cross section, Beam elevation, Column cross section, Column layout, Ground floor Roof slab bottom reinforcement, Ground floor slab general arrangement plan, Ground Floor slab top reinforcement , Ground floor slab bottom reinforcement, Top floor slab general arrangement plan , Top floor roof slab top reinforcement drawings and their details can be downloaded.

The model is created and supports, columns, beams and slabs are assigned.





7.2 Assigning Wind Load, Dead Load and Live Load

1) Wind Load

In the loads and definitions, we should define and assign wind loads. Click on calculate as perASCE-7 and enter the values as per IS 875 part-3. Then assign the values in the building.

Wall load =Length x Height x Thickness of wall x Unit weight of GFRG Panel

=1m x 3.05m x 0.124m x 0.433

Floor load =Length x Width x Thickness of slab x Unit weight of concrete

=1m x 1m x 0.15 x 25kN/M^3

2) Dead Load

Wall load =Length x Height x Thickness of wall x Unit weight of brick

=1m x 3m x 0.23m x 20 kN/m^3

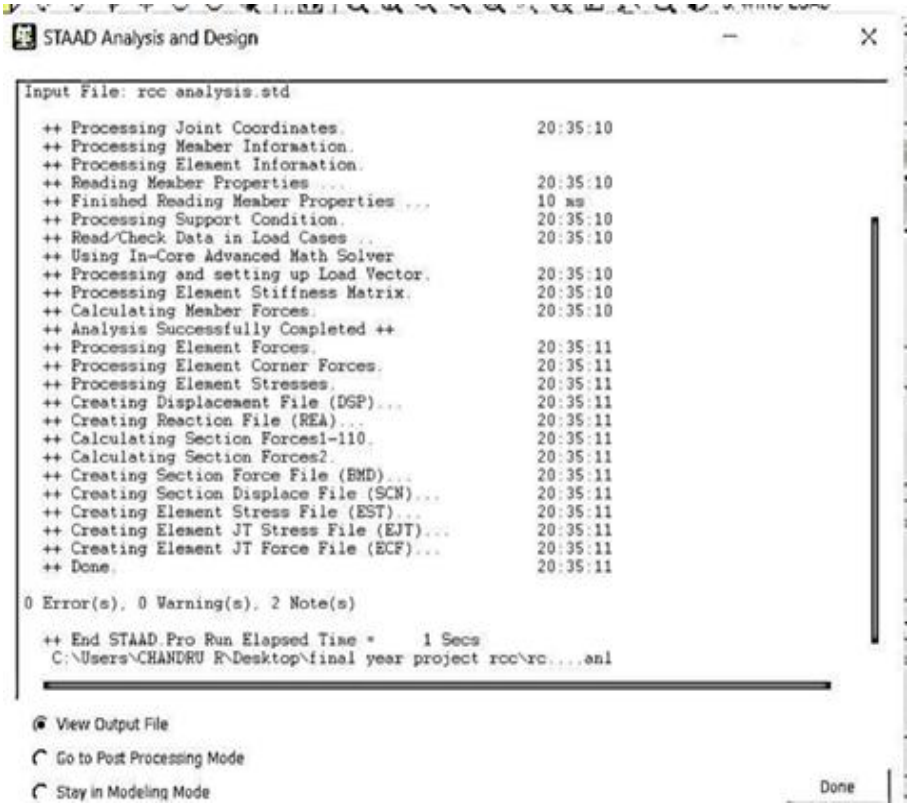
Floor load =Length x Width x Thickness of slab x Unit weight of concrete

=1m x 1m x 0.15 x 25kN/M^3

3) Live load

Live loads are also called imposed loads are calculates as per IS-875 Part-2.

7.3 Run Analysis



7.4 Shear, Membrane and Bending Summary for RCC

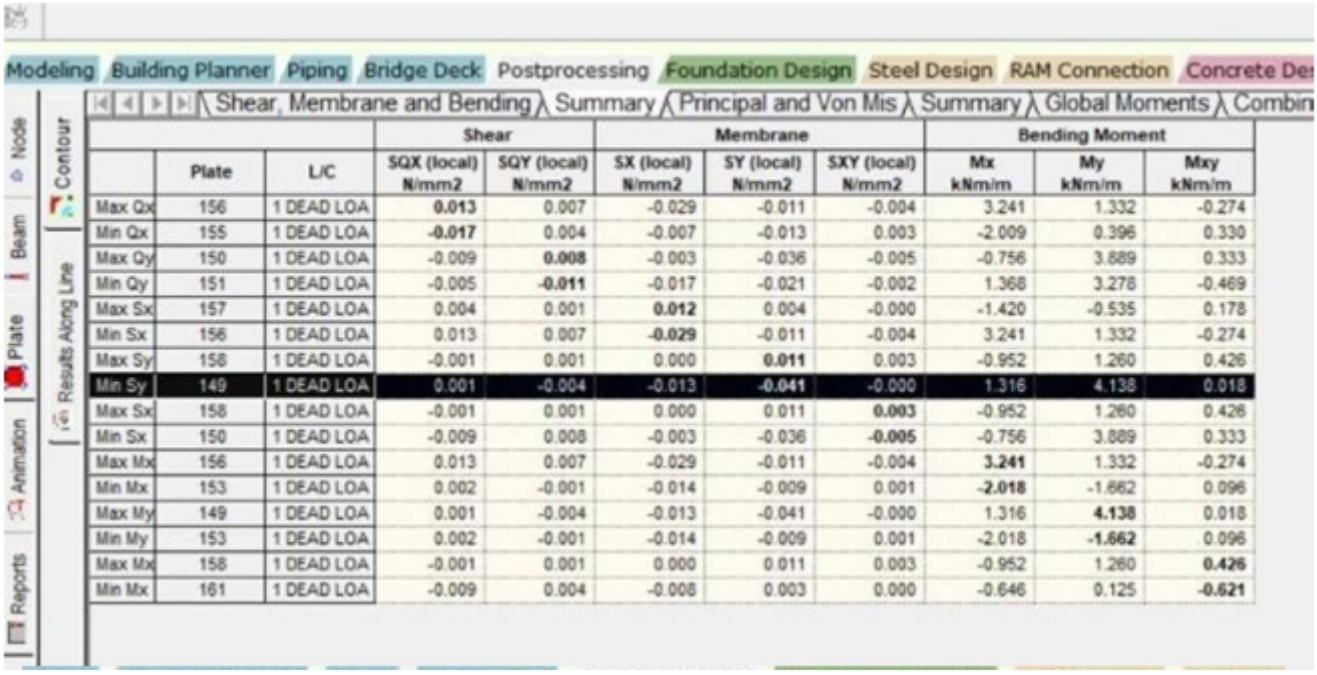


	Plate	L/C	Shear		Membrane			Bending Moment		
			SQX (local) N/mm2	SQY (local) N/mm2	SX (local) N/mm2	SY (local) N/mm2	SXY (local) N/mm2	Mx kNm/m	My kNm/m	Mxy kNm/m
Max Qx	156	1 DEAD LOA	**0.013**	0.007	-0.029	-0.011	-0.004	3.241	1.332	-0.274
Min Qx	155	1 DEAD LOA	**-0.017**	0.004	-0.007	-0.013	0.003	-2.009	0.396	0.330
Max Qy	150	1 DEAD LOA	-0.009	**0.008**	-0.003	-0.036	-0.005	-0.756	3.889	0.333
Min Qy	151	1 DEAD LOA	-0.005	**-0.011**	-0.017	-0.021	-0.002	1.368	3.278	-0.469
Max Sx	157	1 DEAD LOA	0.004	0.001	**0.012**	0.004	-0.000	-1.420	-0.535	0.178
Min Sx	156	1 DEAD LOA	0.013	0.007	**-0.029**	-0.011	-0.004	3.241	1.332	-0.274
Max Sy	158	1 DEAD LOA	-0.001	0.001	0.000	**0.011**	0.003	-0.952	1.260	0.426
Min Sy	149	1 DEAD LOA	0.001	-0.004	-0.013	**-0.041**	-0.000	1.316	4.138	0.018
Max Sx	158	1 DEAD LOA	-0.001	0.001	0.000	0.011	**0.003**	-0.952	1.260	0.426
Min Sx	150	1 DEAD LOA	-0.009	0.008	-0.003	-0.036	**-0.005**	-0.756	3.889	0.333
Max Mx	156	1 DEAD LOA	0.013	0.007	-0.029	-0.011	-0.004	**3.241**	1.332	-0.274
Min Mx	153	1 DEAD LOA	0.002	-0.001	-0.014	-0.009	0.001	**-2.018**	-1.662	0.096
Max My	149	1 DEAD LOA	0.001	-0.004	-0.013	-0.041	-0.000	1.316	**4.138**	0.018
Min My	153	1 DEAD LOA	0.002	-0.001	-0.014	-0.009	0.001	-2.018	**-1.662**	0.096
Max Mx	158	1 DEAD LOA	-0.001	0.001	0.000	0.011	0.003	-0.952	1.260	**0.426**
Min Mx	161	1 DEAD LOA	-0.009	0.004	-0.008	0.003	0.000	-0.646	0.125	**-0.621**

deling | Building Planner | Piping | Bridge Deck | Postprocessing | Foundation Design | Steel Design | RAM Con

Shear, Membrane and Bending | Summary | Principal and Von Mis | Summary | Globa

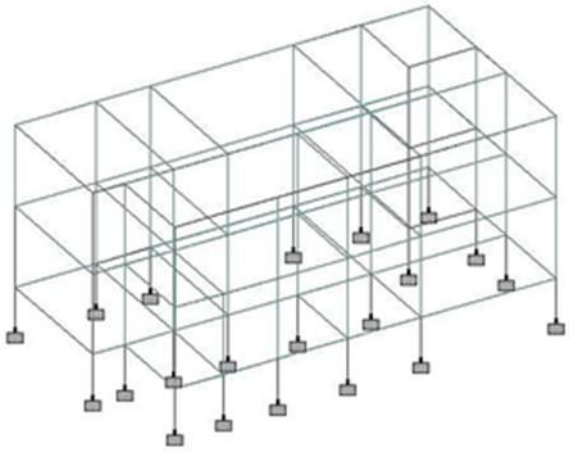
Contour | Results Along Line

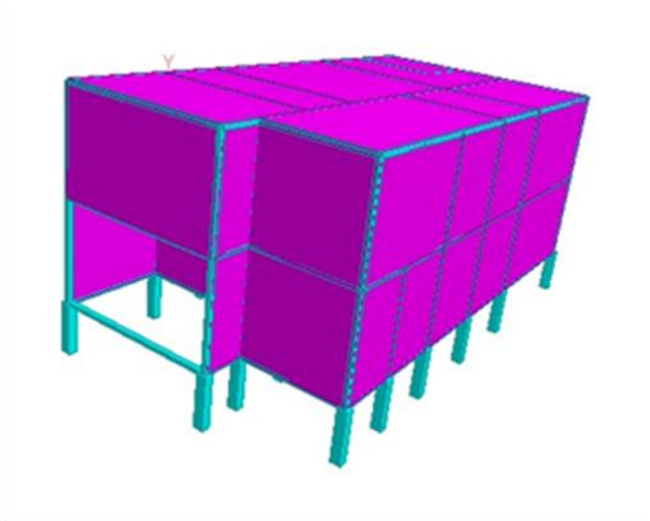
	Plate	L/C	Principal		Von Mis		Tresca	
			Top N/mm2	Bottom N/mm2	Top N/mm2	Bottom N/mm2	Top N/mm2	Bottom N/mm2
Max Pri	149	1 DEAD LOA	**1.063**	-0.363	0.940	1.013	1.063	1.144
Min Prin	153	1 DEAD LOA	**-0.558**	0.428	0.511	0.488	0.558	0.531
Max Pri	155	1 DEAD LOA	0.105	**0.540**	0.614	0.615	0.660	0.670
Min Prin	149	1 DEAD LOA	0.338	**-1.144**	0.940	1.013	1.063	1.144
Max Vo	150	1 DEAD LOA	1.007	0.206	**1.127**	1.196	1.217	1.286
Min Vo	155	3 WIND LOA	-0.001	-0.003	**0.002**	0.003	0.002	0.003
Max Vo	150	1 DEAD LOA	1.007	0.206	1.127	**1.196**	1.217	1.286
Min Vo	152	3 WIND LOA	-0.004	-0.000	0.004	**0.001**	0.004	0.001
Max Tr	150	1 DEAD LOA	1.007	0.206	1.127	1.196	**1.217**	1.286
Min Tre	155	3 WIND LOA	-0.001	-0.003	0.002	0.003	**0.002**	0.003
Max Tr	150	1 DEAD LOA	1.007	0.206	1.127	1.196	1.217	**1.286**
Min Tre	152	3 WIND LOA	-0.004	-0.000	0.004	0.001	0.004	**0.001**

7.5 Analysis of GFRG Building using STAAD PRO

The above Auto CAD plan is drawn in staad Pro for both RCC GFRG structure and the Results are noted and compared . The Model is created first and loads such as Dead load , Live load ,and wind load is applied . The structure is checked for error and the report is generated . Bending moment diagram ,Bending moment , shear force etc are generated . Beam cross section , Beam elevation , Column cross section ,Column layout ,Ground floor Roof slab bottom reinforcement , Ground floor slab general arrangement plan ,Ground Floor slab top reinforcement , Ground floor slab bottom reinforcement , Top floor slab general arrangement plan , Top floor roof slab top reinforcement drawings and their details can be downloaded

The model is created and supports, columns, beams and slabs are assigned.





7.6 Assigning Wind Load, Dead Load and Live Load

1) Wind Load

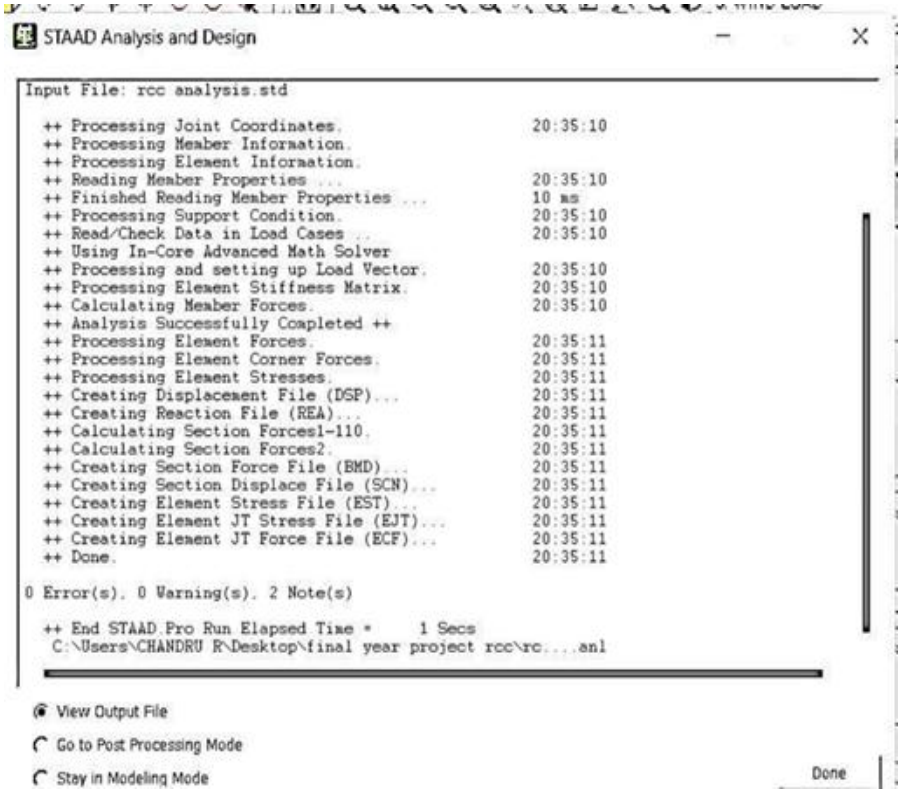
In the loads and definitions, we should define and assign wind loads. Click on calculate as perASCE-7 and enter the values as per IS 875 part-3. Then assign the values in the building.

2) Dead Load

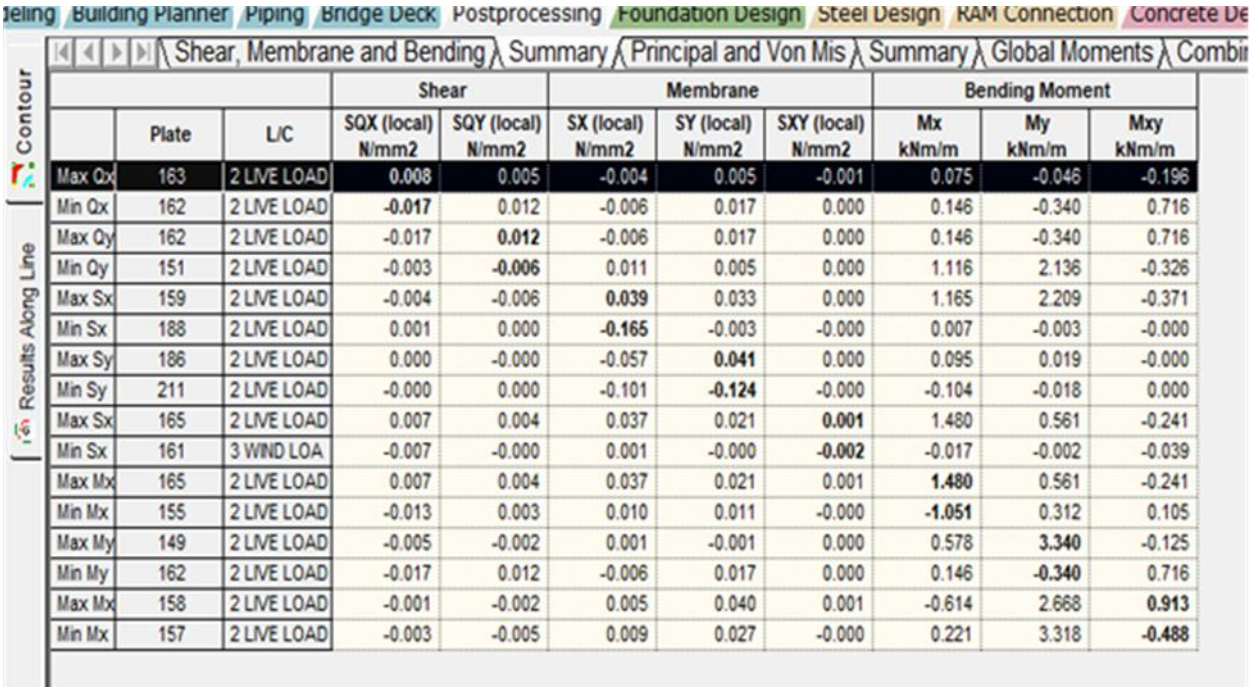
3) Live Load

Live loads are also called imposed loads are calculates as per IS-875 Part-2.

7.7 Run Analysis



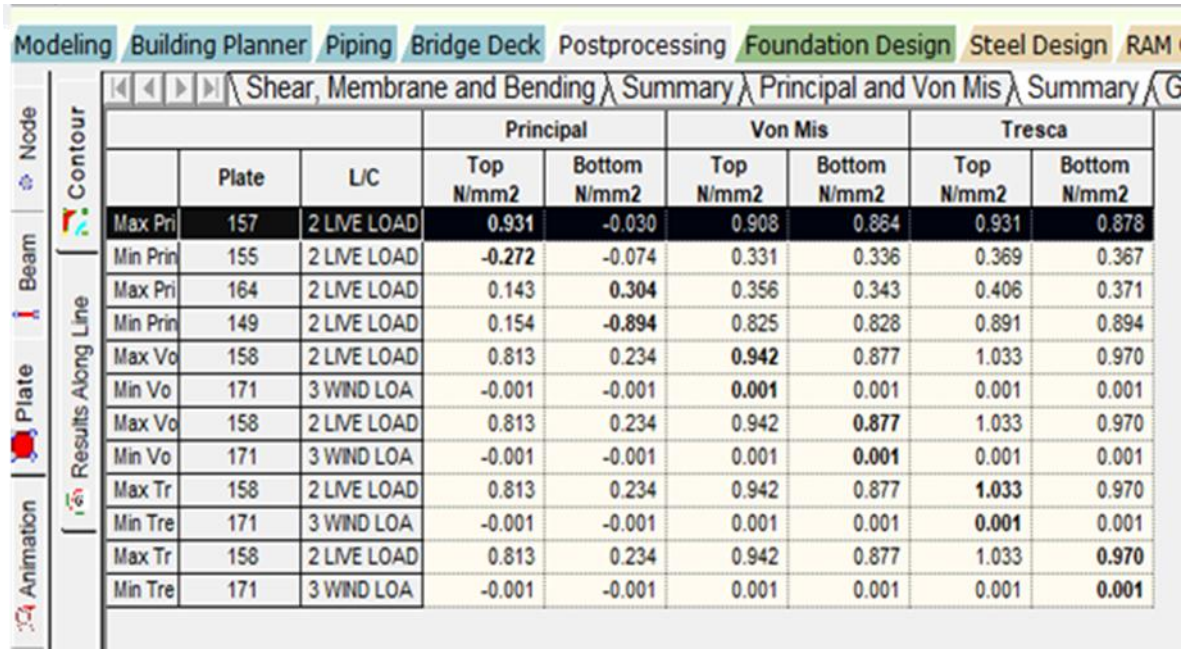
7.8 Shear, Membrane and Bending Summary for GFRG



Shear, Membrane and Bending | Summary | Principal and Von Mis | Summary | Global Moments | Combi

Contour | Results Along Line

	Plate	L/C	Shear		Membrane			Bending Moment		
			SQX (local) N/mm2	SQY (local) N/mm2	SX (local) N/mm2	SY (local) N/mm2	SXY (local) N/mm2	Mx kNm/m	My kNm/m	Mxy kNm/m
Max Qx	163	2 LIVE LOAD	**0.008**	0.005	-0.004	0.005	-0.001	0.075	-0.046	-0.196
Min Qx	162	2 LIVE LOAD	**-0.017**	0.012	-0.006	0.017	0.000	0.146	-0.340	0.716
Max Qy	162	2 LIVE LOAD	-0.017	**0.012**	-0.006	0.017	0.000	0.146	-0.340	0.716
Min Qy	151	2 LIVE LOAD	-0.003	**-0.006**	0.011	0.005	0.000	1.116	2.136	-0.326
Max Sx	159	2 LIVE LOAD	-0.004	-0.006	**0.039**	0.033	0.000	1.165	2.209	-0.371
Min Sx	188	2 LIVE LOAD	0.001	0.000	**-0.165**	-0.003	-0.000	0.007	-0.003	-0.000
Max Sy	186	2 LIVE LOAD	0.000	-0.000	-0.057	**0.041**	0.000	0.095	0.019	-0.000
Min Sy	211	2 LIVE LOAD	-0.000	0.000	-0.101	**-0.124**	-0.000	-0.104	-0.018	0.000
Max Sx	165	2 LIVE LOAD	0.007	0.004	0.037	0.021	**0.001**	1.480	0.561	-0.241
Min Sx	161	3 WIND LOA	-0.007	-0.000	0.001	-0.000	**-0.002**	-0.017	-0.002	-0.039
Max Mx	165	2 LIVE LOAD	0.007	0.004	0.037	0.021	0.001	**1.480**	0.561	-0.241
Min Mx	155	2 LIVE LOAD	-0.013	0.003	0.010	0.011	-0.000	**-1.051**	0.312	0.105
Max My	149	2 LIVE LOAD	-0.005	-0.002	0.001	-0.001	0.000	0.578	**3.340**	-0.125
Min My	162	2 LIVE LOAD	-0.017	0.012	-0.006	0.017	0.000	0.146	**-0.340**	0.716
Max Mx	158	2 LIVE LOAD	-0.001	-0.002	0.005	0.040	0.001	-0.614	2.668	**0.913**
Min Mx	157	2 LIVE LOAD	-0.003	-0.005	0.009	0.027	-0.000	0.221	3.318	**-0.488**



			Principal		Von Mis		Tresca	
	Plate	L/C	Top N/mm2	Bottom N/mm2	Top N/mm2	Bottom N/mm2	Top N/mm2	Bottom N/mm2
Max Pri	157	2 LIVE LOAD	**0.931**	-0.030	0.908	0.864	0.931	0.878
Min Prin	155	2 LIVE LOAD	**-0.272**	-0.074	0.331	0.336	0.369	0.367
Max Pri	164	2 LIVE LOAD	0.143	**0.304**	0.356	0.343	0.406	0.371
Min Prin	149	2 LIVE LOAD	0.154	**-0.894**	0.825	0.828	0.891	0.894
Max Vo	158	2 LIVE LOAD	0.813	0.234	**0.942**	0.877	1.033	0.970
Min Vo	171	3 WIND LOA	-0.001	-0.001	**0.001**	0.001	0.001	0.001
Max Vo	158	2 LIVE LOAD	0.813	0.234	0.942	**0.877**	1.033	0.970
Min Vo	171	3 WIND LOA	-0.001	-0.001	0.001	**0.001**	0.001	0.001
Max Tr	158	2 LIVE LOAD	0.813	0.234	0.942	0.877	**1.033**	0.970
Min Tre	171	3 WIND LOA	-0.001	-0.001	0.001	0.001	**0.001**	0.001
Max Tr	158	2 LIVE LOAD	0.813	0.234	0.942	0.877	1.033	**0.970**
Min Tre	171	3 WIND LOA	-0.001	-0.001	0.001	0.001	0.001	**0.001**

8.ESTIMATION FOR RCC AND GFRG BUILDING USING MS EXCEL

8.1 Estimation for RCC Building

RESIDENTIAL CONVENTIONAL BUILDING

Sl.No	Description of Item Of Work	Nos	L	B	D	Counts	Unit	Unit Rate	Amount (Rs)
1	**SUB-STRUCTURE**								
A	Site Clearance					125.00	**m²**		4000
B	Excavation	29	2.00	2.00	3.20	371.20	**m³**	245	90944.00
C	Filling & Compacting Area	29	2.00	2.00	2.60	301.60	**m³**	153	46144.80
D	Crushed Stone For PCC	29	2.00	2.00	0.05	5.80	**m³**	315	1827.00
E	C.C Bed 1:4:8 mix	29	2.00	1.60	0.10	9.28	**m³**	980	9094.40
F	PE Film (0.05 THK)	29	2.00	2.00	-	116.00	**m²**	660	76560.00
G	Anti-termite	29	2.00	2.00	-	116.00	**m²**	425	49300.00
H	Formwork for Footing	29	2.00	0.36	-	20.88	**m²**	180	3758.40
	CONCRETE QUANTITY - Upto Plinth Level								
2	**CONCRETE**								
A	Foundation For Footing	29	1.80	1.80	0.36	33.83	**m³**	6500	219866.40
B	Column - Concrete M25	29	0.23	0.30	4.00	8.00	**m³**	6500	52026.00
C	Plinth Beam - Concrete M25	52	0.23	0.38	6.00	27.27	**m³**	6500	177247.20

D	Plinth Beam - Concrete M25	39	0.23	0.38	5.00	17.04	m^3	6500	110779.50
E	Flooring P.C.C in 1:4:8 mix	1	12.81	8.62	0.15	16.56	m^3	6500	107661.65
3	**CONCRETE QUANTITY - Plinth Level to Roof Level**								
A	Column - Concrete M25	2	0.23	0.30	15.00	2.07	m^3	6500	13455.00
B	Floor Beam - Concrete M25	2	0.23	0.38	26.00	4.54	m^3	6500	29541.20
C	Floor Beam - Concrete M25	2	0.23	0.38	20.00	3.50	m^3	6500	22724.00
D	Floor Slab - Concrete M25	2	12.81	8.62	0.15	33.13	m^3	6500	215323.29
E	Lintel Concrete	2	0.23	0.23	43.00	4.55	m^3	6500	29571.10
F	SunShade Concrete	16	0.75	1.50	0.13	2.25	m^3	6500	14625.00
4	**BRICK WALL**								
	Short Wall	43	0.23	3.50	1.00	34.62	m^3		
	Long Wall	43	0.23	3.50	1.00	34.62	m^3		
	Deduction Door	12	2.30	1.07	0.23	6.79	m^3		
	Deduction Window	16	1.52	1.37	0.23	7.66	m^3		
A	Total Volume of Brick					54.77	m^3	1600	87639.05
B	Plastering Area Inside	193.54/0.23				238.15	m^2	500	119074.80
C	Plastering Area Outside	193.54/0.23				238.15	m^2	500	119074.80
D	Main Doors	12	1.52	1.37		24.99	m^2	1600	39982.08
E	Access Doors	2	0.93	1.33		2.47	m^2	1600	3958.08
F	Windows	16	1.52	1.37		33.32	m^3	1600	53309.44
5	**FLOORING**								
A	Marbles	2	12.81	8.62	-	220.84	m^2	550	121464.42
B	WATER PROOF : SSAP Waterproof System	2	12.81	8.62	-	220.84	m^2	60	13250.66
C	Ceiling plastering	2	12.81	8.62	-	220.84	m^2	500	110422.20
6	**STAIR CASE**								
A	Waist slab	2	3.00	4.00	0.13	24.00	m^3		
B	Landing 1	2	3.00	4.00	0.13	24.00	m^3		
C	Landing 2	2	3.00	2.00	0.13	12.00	m^3		
D	Total					60.00	m^3	6500	390000.00
7	**REINFORCEMENT**								
A	Slab Reinforement 10 Dia	-	-	-	-	4420.00	**kg**	70	309400.00

B	Beam ,waist ,Sunshade & Lintel Reinforement 6, 12 & 20 Dia	-	-	-	-	2140.00	**kg**	70	149800.00
C	Column Reinforement 6 & 20 Dia	-	-	-	-	4500.00	**kg**	70	315000.00
D	Footing Reinforement 16 Dia	-	-	-	-	2100.00	**kg**	70	147000.00
8	**Painting**								
A	Inner wall- painting	193.54/0.23				238.15	**m²**	60	14288.98
B	Outer wall- painting	841.47/0.23				1035.43	**m²**	60	62125.98
C	Painting for Joineries	8	2.50	1.00		20.00	**m²**	60	1200.00
D	Painting for Grill work	3	1.20	0.90		3.24	**m³**	60	194.40
	TOTAL COST								3331633.83
9	Elevation work & Grill Work	2%							66632.68
10	Electrical work	10%							333163.38
11	Plumbing work	15%							499745.07
12	Supervisor charge	1%							33316.34
13	Land scaping	4%							133265.35
									4397756.66
	SUPERVISIONS CHARGE	15%.							659663.50
	TOTAL COST FOR CONSTRUCTION			**Rs.**					5057420.15

8.2 Estimation for GFRG Building

RESIDENTIAL GFRG PANEL BUILDING									
Sl.No	**Description of Item Of Work**	**Nos**	**L**	**B**	**D**	**Counts**	**Unit**	**Unit Rate**	**Amount (Rs)**
1	**SUB-STRUCTURE**								
A	Site Clearance					125.00	**m²**		4000
B	Excavation	29	1.80	1.80	3.20	300.67	**m³**	245	73664.64
C	Filling & Compacting Area	29	1.80	1.80	2.60	244.30	**m³**	153	37377.29
D	Crushed Stone For PCC	29	1.80	1.80	0.05	4.70	**m³**	315	1479.87
E	C.C Bed 1:4:8 mix	29	1.80	1.80	0.10	9.40	**m³**	980	9208.08
F	PE Film (0.05 THK)	29	1.80	1.80	-	93.96	**m²**	660	62013.60

G	Anti-termite	29	1.80	1.80	-	93.96	m^2	425	39933.00
H	Formwork for Footing	29	1.80	0.36	-	18.79	m^2	180	3382.56
	CONCRETE QUANTITY - Upto Plinth Level								
2	**CONCRETE**								
A	Foundation For Footing	29	1.60	1.60	0.36	26.73	m^3	6500	173721.60
B	Column - Concrete M25	29	0.23	0.30	4.00	8.00	m^3	6500	52026.00
C	Plinth Beam - Concrete M25	52	0.23	0.38	6.00	27.27	m^3	6500	177247.20
D	Plinth Beam - Concrete M25	39	0.23	0.38	5.00	17.04	m^3	6500	110779.50
E	Flooring P.C.C in 1:4:8 mix	1	12.81	8.62	0.15	16.56	m^3	6500	107661.65
3	**CONCRETE QUANTITY - Plinth Level to Roof Level**								
A	Column - Concrete M25	2	0.23	0.30	15.00	2.07	m^3	6500	13455.00
B	GFRG Panel Slab	2	12.81	8.62	-	220.84	m^2	800	176675.52
C	Lintel Concrete	2	0.23	0.23	43.00	4.55	m^3	6500	29571.10
D	SunShade Concrete	16	0.75	1.50	0.13	2.25	m^3	6500	14625.00
4	**GFRG PANEL WALLS**								
	GFRG Panel Walls	18	12.00	0.12	3.00	77.76	m^2		
	Deduction Door	12	2.30	1.07	0.23	29.53	m^2		
	Deduction Window	16	1.52	1.37	0.23	33.32	m^2		
A	Total area of GFRG Panel					14.91	m^2	1120	16698.75
B	Main Doors	12	1.52	1.37		24.99	m^2	1600	39982.08
C	Access Doors	2	0.93	1.33		2.47	m^2	1600	3958.08
D	Windows	16	1.52	1.37		33.32	m^3	1600	53309.44
5	**FLOORING**								
A	Marbles	2	12.81	8.62	-	220.84	m^2	550	121464.42
B	WATER PROOF : SSAP Waterproof System	2	12.81	8.62	-	220.84	m^2	60	13250.66
C	Ceiling plastering	2	12.81	8.62	-	220.84	m^2	250	55211.10
6	**STAIR CASE**								
A	Waist slab	2	3.00	4.00	0.13	24.00	m^3		
B	Landing 1	2	3.00	4.00	0.13	24.00	m^3		
C	Landing 2	2	3.00	2.00	0.13	12.00	m^3		
D	Total					60.00	m^3	6500	390000.00
7	**REINFORCEMENT**								

A	waist ,Sunshade & Lintel Reinforement 6, 12 & 20 Dia	-	-	-	-	640.00	**kg**	70	44800.00
B	Column Reinforement 6 & 20 Dia	-	-	-	-	2640.00	**kg**	70	184800.00
C	Footing Reinforement 16 Dia	-	-	-	-	1800.00	**kg**	70	126000.00
8	**Painting**								
A	Painting for Joineries	8	2.50	1.00		20.00	**m^2**	60	1200.00
B	Painting for Grill work	3	1.20	0.90		3.24	**m^3**	60	194.40
	TOTAL COST								2137690.54
9	Elevation work & Grill Work	2%							42753.81
10	Electrical work	10%							213769.05
11	Plumbing work	15%							320653.58
12	Supervisor charge	1%							21376.91
13	Land scaping	4%							85507.62
									2821751.51
	SUPERVISIONS CHARGE	15%.							423262.73
	TOTAL COST FOR CONSTRUCTION			**Rs.**					3245014.24

9.SCHEDULING FOR RCC AND GFRG BUILDING USING MS PROJECT

9.1 Scheduling for RCC Building

Task Name	Duration	Start	Finish
RCC Scheduling	**150.56 days**	**September 1, 2022 8:00 AM**	**March 17, 2023 11:00 AM**
Site Clearance	1 day	September 1, 2022 8:00 AM	September 2, 2022 9:00 AM
Marking	1 day	September 2, 2022 9:00 AM	September 3, 2022 10:00 AM
Excavation	1 day	September 3, 2022 10:00 AM	September 5, 2022 11:00 AM
PCC 1:5:10	1 day	September 5, 2022 11:00 AM	September 6, 2022 12:00 PM
Mat Fixing	2 days	September 6, 2022 8:00 AM	September 8, 2022 10:00 AM
Column Startup	2 days	September 8, 2022 10:00 AM	September 10, 2022 12:00 PM

Shuttering for footing	1 day	September 10, 2022 1:00 PM	September 12, 2022 2:00 PM
Concreting for footing	1 day	September 12, 2022 2:00 PM	September 13, 2022 3:00 PM
Curing	15 days	September 13, 2022 3:00 PM	October 3, 2022 2:00 PM
Backfilling	1 day	September 13, 2022 3:00 PM	September 14, 2022 4:00 PM
Centring work in Plinth beam	3 days	September 14, 2022 4:00 PM	September 19, 2022 10:00 AM
Shuttering work in Plinth beam	8 days	September 19, 2022 10:00 AM	September 29, 2022 10:00 AM
Concreting in Plinth Beam	1 day	September 29, 2022 10:00 AM	September 30, 2022 11:00 AM
Curing	15 days	September 30, 2022 11:00 AM	October 20, 2022 10:00 AM
Flooring P.C.C in 1:4:8 mix	4 days	September 30, 2022 11:00 AM	October 5, 2022 4:00 PM
Centring work in Column upto GF Roof	4 days	October 5, 2022 4:00 PM	October 11, 2022 11:00 AM
Column Casting upto GF Roof	12 days	October 11, 2022 11:00 AM	October 26, 2022 4:00 PM
Curing	15 days	October 26, 2022 4:00 PM	November 15, 2022 3:00 PM
Brickwork upto GF Roof	10 days	October 26, 2022 4:00 PM	November 9, 2022 9:00 AM
Curing	15 days	November 9, 2022 9:00 AM	November 28, 2022 5:00 PM
Ground Floor Beam, Slab Formwork and Casting	20 days	November 9, 2022 9:00 AM	December 5, 2022 2:00 PM
Lintel and Sunshade Slab formwork Casting	1 day	December 5, 2022 2:00 PM	December 6, 2022 3:00 PM
Curing	15 days	December 6, 2022 3:00 PM	December 26, 2022 2:00 PM
Centring work in First floor roof	2 days	December 6, 2022 3:00 PM	December 8, 2022 5:00 PM
Casting and filling of concrete in GF Roof	1 day	December 9, 2022 8:00 AM	December 10, 2022 9:00 AM
Curing	15 days	December 10, 2022 9:00 AM	December 29, 2022 5:00 PM
Electrical and Plumbing work for First Floor	7 days	December 10, 2022 9:00 AM	December 19, 2022 5:00 PM
Centring work in column upto First floor roof	2 days	December 20, 2022 8:00 AM	December 22, 2022 10:00 AM
Column Casting upto First floor Roof	1 day	December 22, 2022 10:00 AM	December 23, 2022 11:00 AM
Curing	15 days	December 23, 2022 11:00 AM	January 12, 2023 10:00 AM
Brickwork upto FF Roof	10 days	December 23, 2022 11:00 AM	January 5, 2023 2:00 PM
Curing	15 days	January 5, 2023 2:00 PM	January 25, 2023 12:00 PM

First Floor Lintel and Sunshade Slab Formwork and Casting	1 day	January 5, 2023 2:00 PM	January 6, 2023 3:00 PM
Curing	15 days	January 6, 2023 3:00 PM	January 26, 2023 2:00 PM
Centring work in First floor roof	2 days	January 6, 2023 3:00 PM	January 9, 2023 5:00 PM
Casting and filling of concrete in First Floor Roof	1 day	January 10, 2023 8:00 AM	January 11, 2023 9:00 AM
Curing	15 days	January 11, 2023 9:00 AM	January 30, 2023 5:00 PM
Flooring P.C.C in 1:4:8 mix	4 days	January 11, 2023 9:00 AM	January 16, 2023 2:00 PM
Joinery Fixing & Grillwork for GF & FF	10 days	January 16, 2023 2:00 PM	January 28, 2023 4:00 PM
Plastering	7 days	January 28, 2023 4:00 PM	February 7, 2023 3:00 PM
Painting	15 days	February 7, 2023 3:00 PM	February 27, 2023 2:00 PM
Elevation	7 days	February 27, 2023 2:00 PM	March 8, 2023 12:00 PM
Handing over of site	7 days	March 8, 2023 1:00 PM	March 17, 2023 11:00 AM

9.2 Scheduling for GFRG Building

Task Name	Duration	Start	Finish
GFRG SCHEDULING	**101 days**	**September 1, 2022 8:00 AM**	**December 27, 2022 5:00 PM**
Site Clearance	1 day	September 1, 2022 8:00 AM	September 1, 2022 5:00 PM
Marking	1 day	September 2, 2022 8:00 AM	September 2, 2022 5:00 PM
Excavation	4 days	September 3, 2022 8:00 AM	September 7, 2022 5:00 PM
PCC 1:5:10	1 day	September 8, 2022 8:00 AM	September 8, 2022 5:00 PM
Mat Fixing	2 days	September 9, 2022 8:00 AM	September 10, 2022 5:00 PM
Column Startup	2 days	September 12, 2022 8:00 AM	September 13, 2022 5:00 PM
Shuttering for Footing	1 day	September 14, 2022 8:00 AM	September 14, 2022 5:00 PM
Concreting for Footing	1 day	September 15, 2022 8:00 AM	September 15, 2022 5:00 PM
Curing	15 days	September 16, 2022 8:00 AM	October 3, 2022 5:00 PM
Back filling	1 day	September 16, 2022 8:00 AM	September 16, 2022 5:00 PM
Centring work in Plinth beam	3 days	September 17, 2022 8:00 AM	September 20, 2022 5:00 PM
Shuttering work in Plinth Beam	8 days	September 21, 2022 8:00 AM	September 29, 2022 5:00 PM
Concreting in Plinth Beam	1 day	September 30, 2022 8:00 AM	September 30, 2022 5:00 PM
Curing	15 days	September 30, 2022 8:00 AM	October 17, 2022 5:00 PM
Filling of Concrete in GFRG Panel	2 days	October 18, 2022 8:00 AM	October 19, 2022 5:00 PM
Lintel and Sunshade Slab formwork Casting	1 day	October 20, 2022 8:00 AM	October 20, 2022 5:00 PM
Flooring P.C.C in 1:4:8 mix	4 days	October 21, 2022 8:00 AM	October 25, 2022 5:00 PM
GFRG Panel Fixing in Ground Floor Roof	2 days	October 26, 2022 8:00 AM	October 27, 2022 5:00 PM

Centring work in Ground Floor Roof	2 days	October 28, 2022 8:00 AM	October 29, 2022 5:00 PM
Filling of Concrete in Ground Floor Roof	1 day	October 31, 2022 8:00 AM	October 31, 2022 5:00 PM
Fixing of GFRG Panels in First Floor	2 days	November 1, 2022 8:00 AM	November 2, 2022 5:00 PM
Filling of Concrete in GFRG Panel	2 days	November 3, 2022 8:00 AM	November 4, 2022 5:00 PM
Flooring P.C.C in 1:4:8 mix	4 days	November 5, 2022 8:00 AM	November 9, 2022 5:00 PM
Lintel and Sunshade Slab formwork Casting	1 day	November 5, 2022 8:00 AM	November 5, 2022 5:00 PM
GFRG Panel Fixing in First Floor Roof	2 days	November 7, 2022 8:00 AM	November 8, 2022 5:00 PM
Centring work in First Floor Roof	2 days	November 9, 2022 8:00 AM	November 10, 2022 5:00 PM
Filling of Concrete in First Floor Roof	1 day	November 11, 2022 8:00 AM	November 11, 2022 5:00 PM
Electrical and Plumbing Work for GF and FF	7 days	November 12, 2022 8:00 AM	November 19, 2022 5:00 PM
Joinery Fixing and Grillwork for GF and FF	10 days	November 12, 2022 8:00 AM	November 23, 2022 5:00 PM
Painting	15 days	November 24, 2022 8:00 AM	December 10, 2022 5:00 PM
Elevation	7 days	December 12, 2022 8:00 AM	December 19, 2022 5:00 PM
Handing over of Site	7 days	December 20, 2022 8:00 AM	December 27, 2022 5:00 PM

10.CONCLUSION

This study investigated the importance of Glass Fiber Reinforced Gypsum (GFRG) structure hasmuch better than Reinforced Cement Concrete (RCC) structures. The panels have good life spanas same as concrete structure. Nowadays the use of panels for construction involves gradually, but still most of the people are not aware in this type of construction practice for residential building from this project we have created some awareness about the construction of panel systems. Initial stage of project is Data has collected in the various aspects of planning, designingand analyzing parameter the second stage of the study is preparing of G+1 building plan using AUTOCADD, Design and analysis using STADD PRO and 3D modelling using SKETCH UP, Estimation using MS EXCEL, Scheduling using MS PROJECT, resource allocation and so on. The main motto of this project is to create awareness among peopleabout the construction at affordable price.

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