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CASE STUDY: CONVENTIONAL CONSTRUCTION VS PREFABRICATED CONSTRUCTION

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ABSTRACT

In this case study, the non structural part of the of the conventional building like walls, w.c., doors and windows are changed by similar prefabricated parts (prefabricated walls, w.c.). After doing so, by using MSP software cost benefit analysis is done. Time and cost taken by construction of conventional building to time and cost taken by construction of same prefabricated building have been comared. Afterwards the conclusions are drawn on the basis of results.

Keywords: Prefabrication, Pre-Cast, Members Of The Building, Microsoft Project.

I. INTRODUCTION

General Prefabrication has been widely regarded as a sustainable construction method in terms of its impact on environmental protection. One important aspect of this perspective is the influence of prefabrication on construction waste reduction and the subsequent waste handling activities, including waste sorting, reuse, recycle, and disposal. Never the less, it would appear that existing research with regard to this topic has failed to take into account its innate dynamic character of the process of construction waste minimization; integrating all essential waste handling activities has never been achieved thus far. This report proposes a dynamic model for quantitatively evaluating the possible impacts arising from the application of prefabrication technology on construction waste reduction and the subsequent waste handling activities.

II. CASE STUDY

18 LATITUDE

Fig. No. 1: Eye view of actual site

Site details

- Name of site :18 Latitude.
- Location of site : Punawale, Mulshi, Pune
- Site Engg: Manoj Gawade
- A proposed commercial building having 7 floor and102shops is taken for case study location is in Punawale, Pune.
- Design Team: Sanskruti construction
- Owner and Developer :G. D. Square and Akshay Chordiya

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- Architect: Rajas Designers
- Cost of project : 16 Cr
- Structural Engineer : Structural Consultants
- Builder :G. D. Squareand Akshay Chordiya
- Area: 92000 sq. ft.
- Commercial building having No. of Towers: 1, No. of Floors: 7 Floors, No. of showroom:6.
- Present condition of the project : Under construction
- No. of Towers: 1,No. of Floors: 7 Floors, No. of showroom: 6

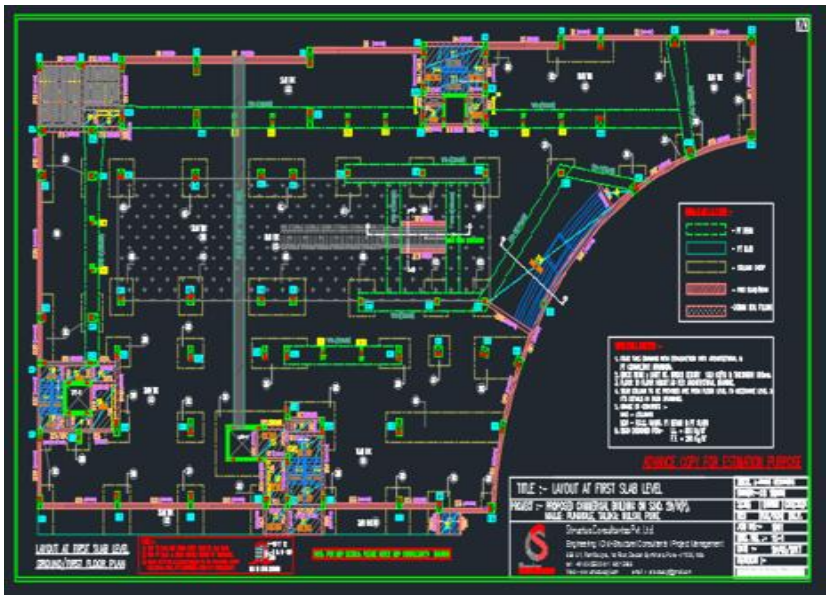

Fig. No. 2: First floor slab

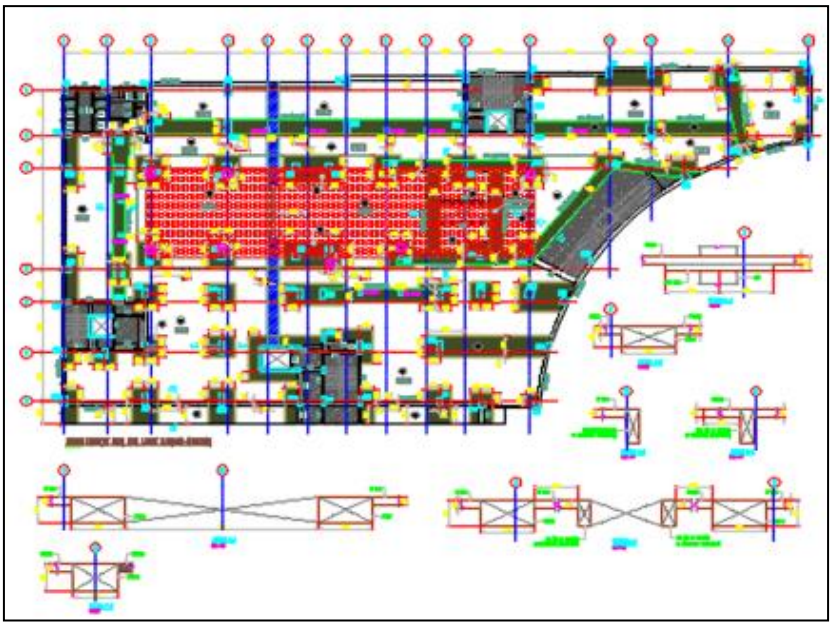

Fig. No.3: First Floor slab Layout

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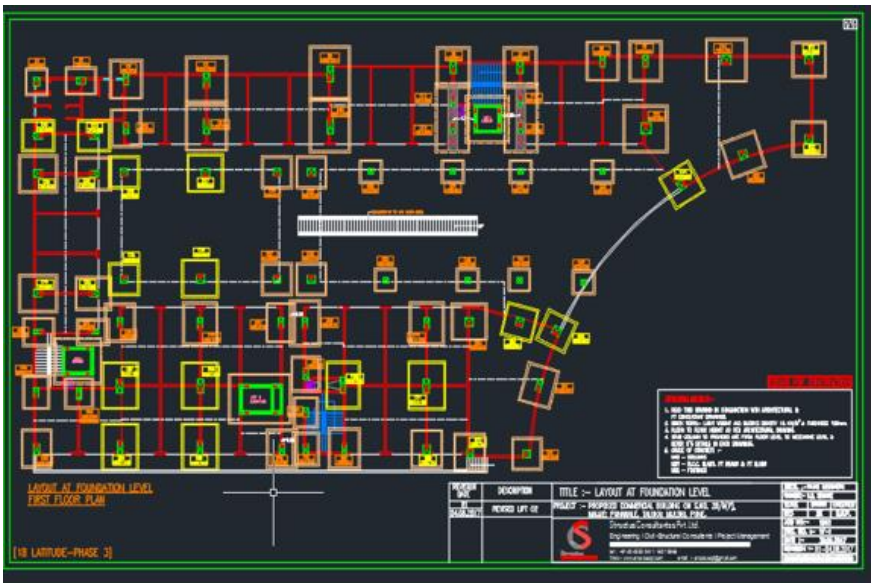

Fig. No. 4: layout plan

III. RESULTS AND DISCUSSION

Table no. 1: Quantity Sheet

Sr No	Description	Concrete Quantity (m/cube)	Cement Cost	Sand Cost	Aggregate Cost
1	Quantity Of Concrete In Pcc	121.989	₹ 2,16,418.25	₹ 7,10,122.37	₹ 17,35,854.67
2	Quantity Of Concrete In Footing	431.23575	₹ 7,65,046.72	₹ 25,10,309.55	₹ 61,36,312.23
3	Quantity Of Concrete In Column G Floor To 7th Floor	165.6	124993.2902	21566.03534	21566.03534
5	Quantity Of Concrete In Beam Plinth Beam to 1st floor and recurring	92.420288	₹ 1,63,960.83	₹ 5,37,996.47	₹ 13,15,102.48
6	Quantity of concrete in slab 1st to 7th floor recurring	154.799	₹ 2,74,625.81	₹ 9,01,115.94	₹ 22,02,727.85
7	Quantity Of Concrete In over head Tanks	158.88328	571064.6403	65686.72707	65686.72707
9	Total	1148.72428	1729354.481 Rs	2770429 Rs	6980506.236 Rs

A WBS is then made from the link of activities that we found out, in the MS Project software, the convectional method is first studied and later the value engineering concept is been applied on it and the difference in cost and time is studied.

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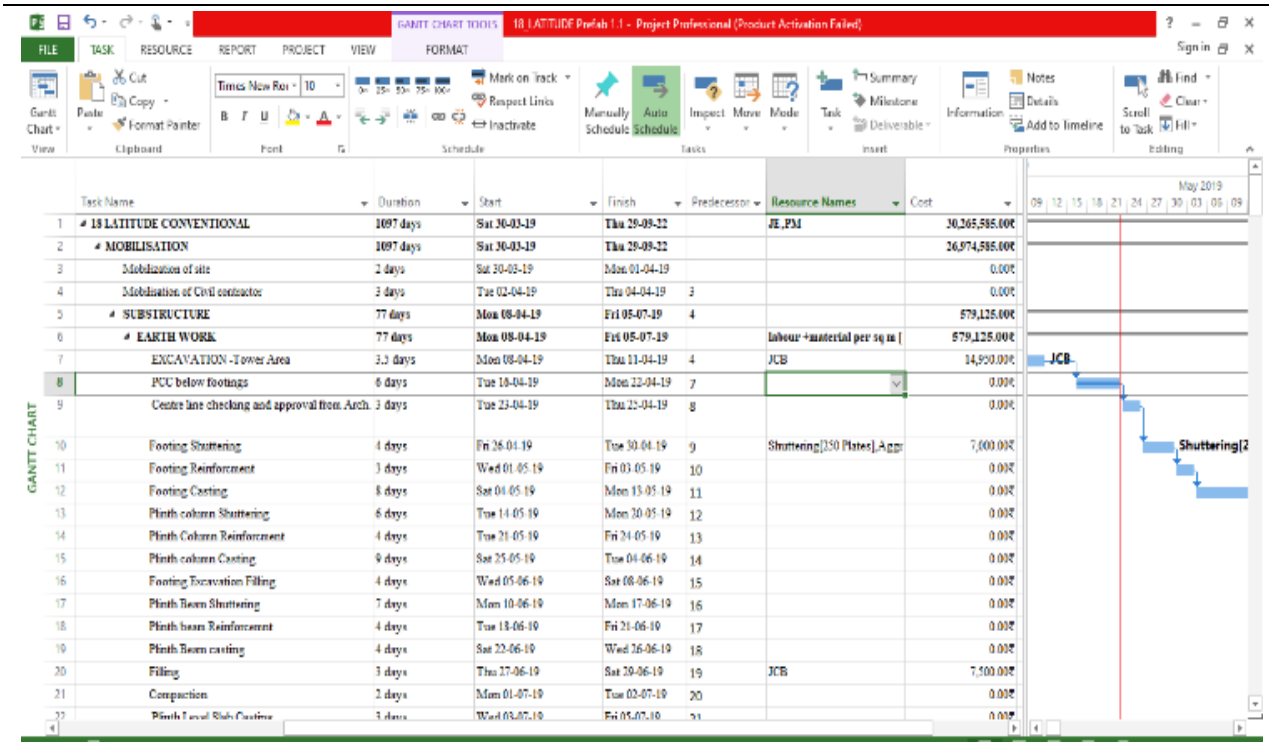
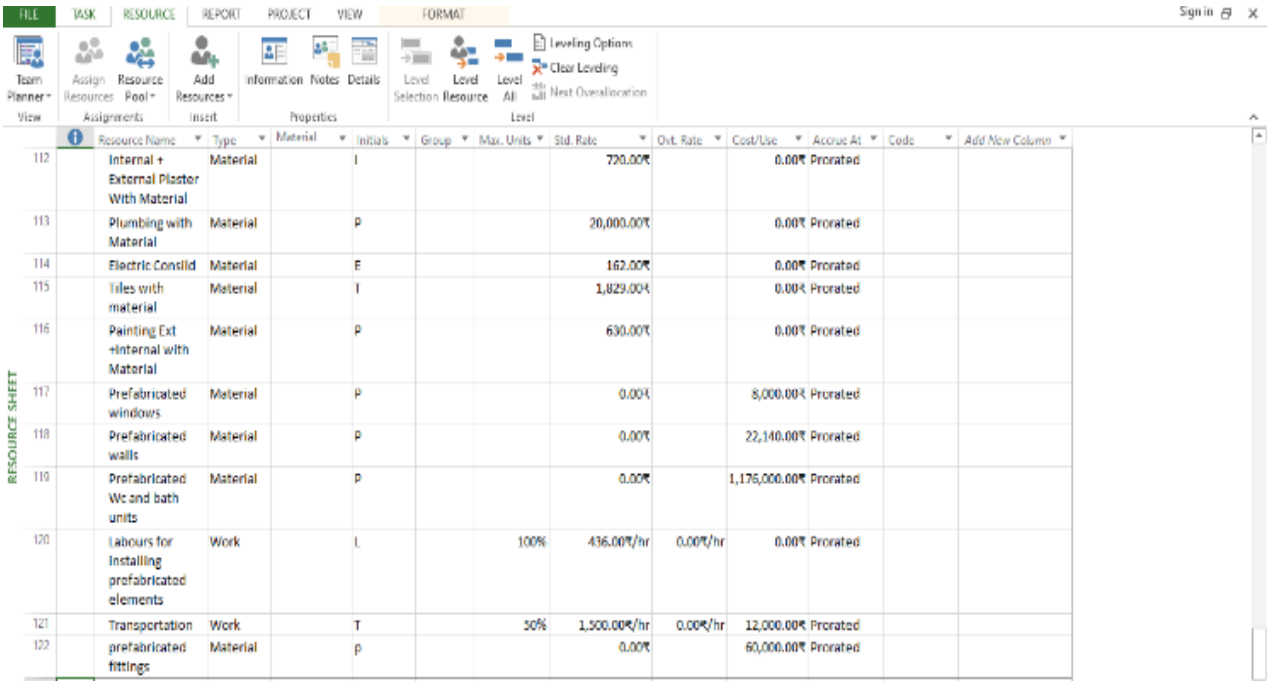


	Task Name	Duration	Start	Finish	Predecessor	Resource Names	Cost
1	18 LATITUDE CONVENTIONAL	1097 days	Sat 30-03-19	Thu 29-09-22		JE,PM	30,265,585.00₹
2	MOBILISATION	1097 days	Sat 30-03-19	Thu 29-09-22			26,974,585.00₹
3	Mobilization of site	2 days	Sat 30-03-19	Mon 01-04-19			0.00₹
4	Mobilization of Civil contractor	3 days	Tue 02-04-19	Thu 04-04-19	3		0.00₹
5	SUBSTRUCTURE	77 days	Mon 08-04-19	Fri 05-07-19	4		579,125.00₹
6	EARTH WORK	77 days	Mon 08-04-19	Fri 05-07-19		labour +material per sq m [	579,125.00₹
7	EXCAVATION -Tower Area	3.3 days	Mon 08-04-19	Thu 11-04-19	4	JCB	14,950.00₹
8	PCC below footings	6 days	Tue 16-04-19	Mon 22-04-19	7		0.00₹
9	Centre line checking and approval from Arch.	3 days	Tue 23-04-19	Thu 25-04-19	8		0.00₹
10	Footing Shuttering	4 days	Fri 26-04-19	Tue 30-04-19	9	Shuttering[250 Plates],Agg	7,000.00₹
11	Footing Reinforcement	3 days	Wed 01-05-19	Fri 03-05-19	10		0.00₹
12	Footing Casting	8 days	Sat 04-05-19	Mon 13-05-19	11		0.00₹
13	Plinth column Shuttering	6 days	Tue 14-05-19	Mon 20-05-19	12		0.00₹
14	Plinth Column Reinforcement	4 days	Tue 21-05-19	Fri 24-05-19	13		0.00₹
15	Plinth column Casting	9 days	Sat 25-05-19	Tue 04-06-19	14		0.00₹
16	Footing Excavation Filling	4 days	Wed 05-06-19	Sat 08-06-19	15		0.00₹
17	Plinth Beam Shuttering	7 days	Mon 10-06-19	Mon 17-06-19	16		0.00₹
18	Plinth beam Reinforcement	4 days	Tue 18-06-19	Fri 21-06-19	17		0.00₹
19	Plinth Beam casting	4 days	Sat 22-06-19	Wed 26-06-19	18		0.00₹
20	Filling	3 days	Thu 27-06-19	Sat 29-06-19	19	JCB	7,500.00₹
21	Compaction	2 days	Mon 01-07-19	Tue 02-07-19	20		0.00₹
22	Plinth Level Slab Casting	3 days	Wed 03-07-19	Fri 05-07-19	21		0.00₹

Fig 5: MSP file of convectional site of 18 latitude, data collected from site

The total cost of the project conventionally taken is 30,265,585.00₹, and 1097 days as seen in the image above.



	Resource Name	Type	Material	Initials	Group	Max. Units	Std. Rate	Ovt. Rate	Cost/Use	Accrue At	Code	Add New Column
112	Internal + External Plaster With Material	Material		I			720.00₹		0.00₹	Prorated		
113	Plumbing with Material	Material		P			20,000.00₹		0.00₹	Prorated		
114	Electric Conduit	Material		E			162.00₹		0.00₹	Prorated		
115	Tiles with material	Material		T			1,829.00₹		0.00₹	Prorated		
116	Painting Ext +Internal with Material	Material		P			630.00₹		0.00₹	Prorated		
117	Prefabricated windows	Material		P			0.00₹		8,000.00₹	Prorated		
118	Prefabricated walls	Material		P			0.00₹		22,140.00₹	Prorated		
119	Prefabricated Wc and bath units	Material		P			0.00₹		1,176,000.00₹	Prorated		
120	Labours for Installing prefabricated elements	Work		L		100%	436.00₹/hr	0.00₹/hr	0.00₹	Prorated		
121	Transportation	Work		T		50%	1,500.00₹/hr	0.00₹/hr	12,000.00₹	Prorated		
122	prefabricated fittings	Material		P			0.00₹		60,000.00₹	Prorated		

Fig 6: Resource sheet transportation

Result from WBS of Conventional Construction from MSP is:

- No. of days – 1097 days
- Cost with material+labour and Machinery- 30,265,585.00₹,

Table no.2: Result from WBS from Conventional Construction

No. of days	1097
Cost	30,265,585.00₹,

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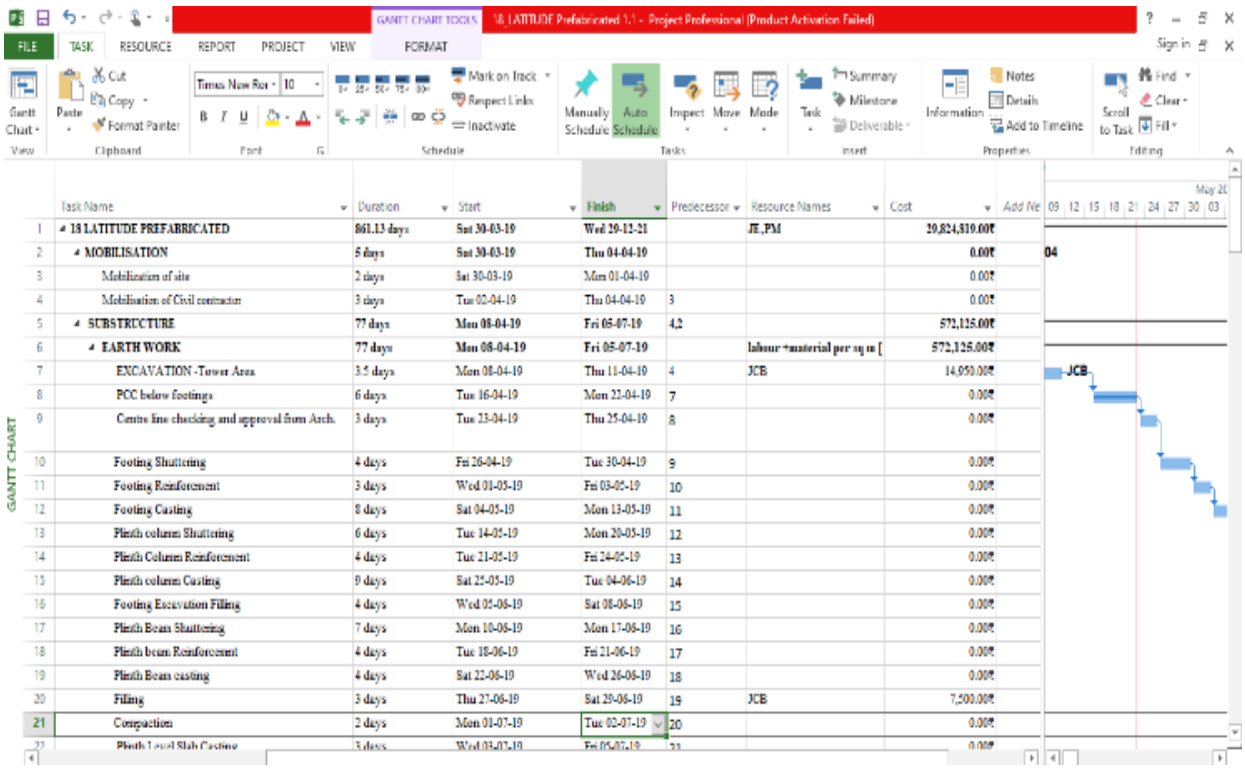
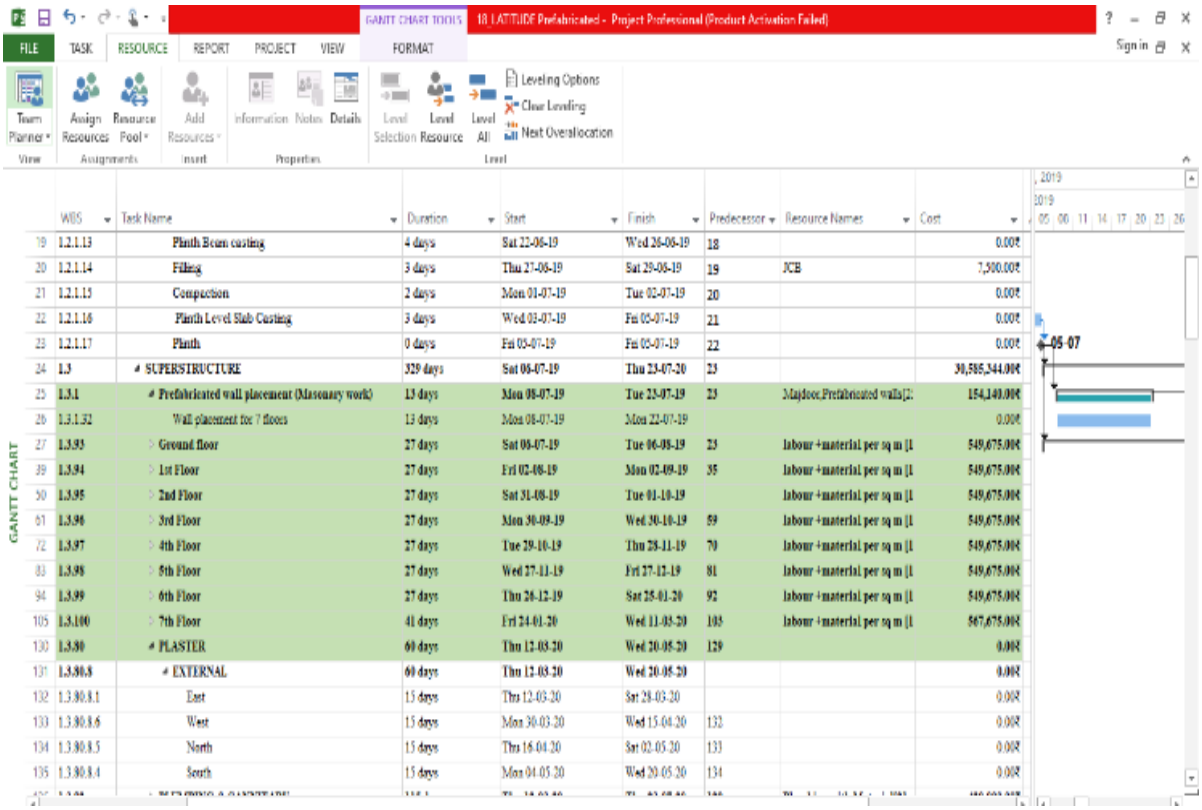
Work breakdown structure of prefabricated construction



	Task Name	Duration	Start	Finish	Predecessor	Resource Names	Cost
1	18 LATITUDE PREFABRICATED	861.13 days	Sat 30-03-19	Wed 29-12-21		JE,PM	29,824,819.00₹
2	MOBILISATION	5 days	Sat 30-03-19	Thu 04-04-19			0.00₹
3	Mobilization of site	2 days	Sat 30-03-19	Mon 01-04-19			0.00₹
4	Mobilisation of Civil contractor	3 days	Tue 02-04-19	Thu 04-04-19	3		0.00₹
5	SUBSTRUCTURE	77 days	Mon 08-04-19	Fri 05-07-19	4,2		572,125.00₹
6	EARTH WORK	77 days	Mon 08-04-19	Fri 05-07-19		labour +material per sq m [	572,125.00₹
7	EXCAVATION -Tower Area	3.5 days	Mon 08-04-19	Thu 11-04-19	4	JCB	14,050.00₹
8	PCC below footings	6 days	Tue 16-04-19	Mon 22-04-19	7		0.00₹
9	Centre line checking and approval from Arch.	3 days	Tue 23-04-19	Thu 25-04-19	8		0.00₹
10	Footing Shuttering	4 days	Fri 26-04-19	Tue 30-04-19	9		0.00₹
11	Footing Reinforcement	3 days	Wed 01-05-19	Fri 03-05-19	10		0.00₹
12	Footing Casting	8 days	Sat 04-05-19	Mon 13-05-19	11		0.00₹
13	Plinth column Shuttering	6 days	Tue 14-05-19	Mon 20-05-19	12		0.00₹
14	Plinth Column Reinforcement	4 days	Tue 21-05-19	Fri 24-05-19	13		0.00₹
15	Plinth column Casting	9 days	Sat 25-05-19	Tue 04-06-19	14		0.00₹
16	Footing Excavation Filling	4 days	Wed 05-06-19	Sat 08-06-19	15		0.00₹
17	Plinth Beam Shuttering	7 days	Mon 10-06-19	Mon 17-06-19	16		0.00₹
18	Plinth beam Reinforcement	4 days	Tue 18-06-19	Fri 21-06-19	17		0.00₹
19	Plinth Beam casting	4 days	Sat 22-06-19	Wed 26-06-19	18		0.00₹
20	Filling	3 days	Thu 27-06-19	Sat 29-06-19	19	JCB	7,500.00₹
21	Compaction	2 days	Mon 01-07-19	Tue 02-07-19	20		0.00₹
22	Plinth Level Slab Casting	3 days	Wed 03-07-19	Fri 05-07-19	21		0.00₹

Fig 7: Work flow for prefabricated building

1. Prefabricated Walls



	WBS	Task Name	Duration	Start	Finish	Predecessor	Resource Names	Cost
19	1.2.1.13	Plinth Beam casting	4 days	Sat 22-06-19	Wed 26-06-19	18		0.00₹
20	1.2.1.14	Filling	3 days	Thu 27-06-19	Sat 29-06-19	19	JCB	7,500.00₹
21	1.2.1.15	Compaction	2 days	Mon 01-07-19	Tue 02-07-19	20		0.00₹
22	1.2.1.16	Plinth Level Slab Casting	3 days	Wed 03-07-19	Fri 05-07-19	21		0.00₹
23	1.2.1.17	Plinth	0 days	Fri 05-07-19	Fri 05-07-19	22		0.00₹
24	1.3	SUPERSTRUCTURE	329 days	Sat 06-07-19	Thu 23-07-20	23		30,595,344.00₹
25	1.3.1	Prefabricated wall placement (Masonary work)	13 days	Mon 08-07-19	Tue 23-07-19	23	Majdoor,Prefabricated walls[2:	154,140.00₹
26	1.3.1.52	Wall placement for 7 floors	13 days	Mon 08-07-19	Mon 22-07-19			0.00₹
27	1.3.93	Ground floor	27 days	Sat 06-07-19	Tue 06-08-19	23	labour +material per sq m [1	549,675.00₹
39	1.3.94	1st Floor	27 days	Fri 02-08-19	Mon 02-09-19	35	labour +material per sq m [1	549,675.00₹
50	1.3.95	2nd Floor	27 days	Sat 31-08-19	Tue 01-10-19		labour +material per sq m [1	549,675.00₹
61	1.3.96	3rd Floor	27 days	Mon 30-09-19	Wed 30-10-19	59	labour +material per sq m [1	549,675.00₹
72	1.3.97	4th Floor	27 days	Tue 29-10-19	Thu 28-11-19	70	labour +material per sq m [1	549,675.00₹
83	1.3.98	5th Floor	27 days	Wed 27-11-19	Fri 27-12-19	81	labour +material per sq m [1	549,675.00₹
94	1.3.99	6th Floor	27 days	Thu 26-12-19	Sat 25-01-20	92	labour +material per sq m [1	549,675.00₹
105	1.3.100	7th Floor	41 days	Fri 24-01-20	Wed 11-03-20	103	labour +material per sq m [1	567,675.00₹
130	1.3.80	PLASTER	60 days	Thu 12-03-20	Wed 20-05-20	129		0.00₹
131	1.3.80.8	EXTERNAL	60 days	Thu 12-03-20	Wed 20-05-20			0.00₹
132	1.3.80.8.1	East	15 days	Thu 12-03-20	Sat 28-03-20			0.00₹
133	1.3.80.8.6	West	15 days	Mon 30-03-20	Wed 15-04-20	132		0.00₹
134	1.3.80.8.5	North	15 days	Thu 16-04-20	Sat 02-05-20	133		0.00₹
135	1.3.80.8.4	South	15 days	Mon 04-05-20	Wed 20-05-20	134		0.00₹

Fig 8: Work flow for Prefabricated Walls

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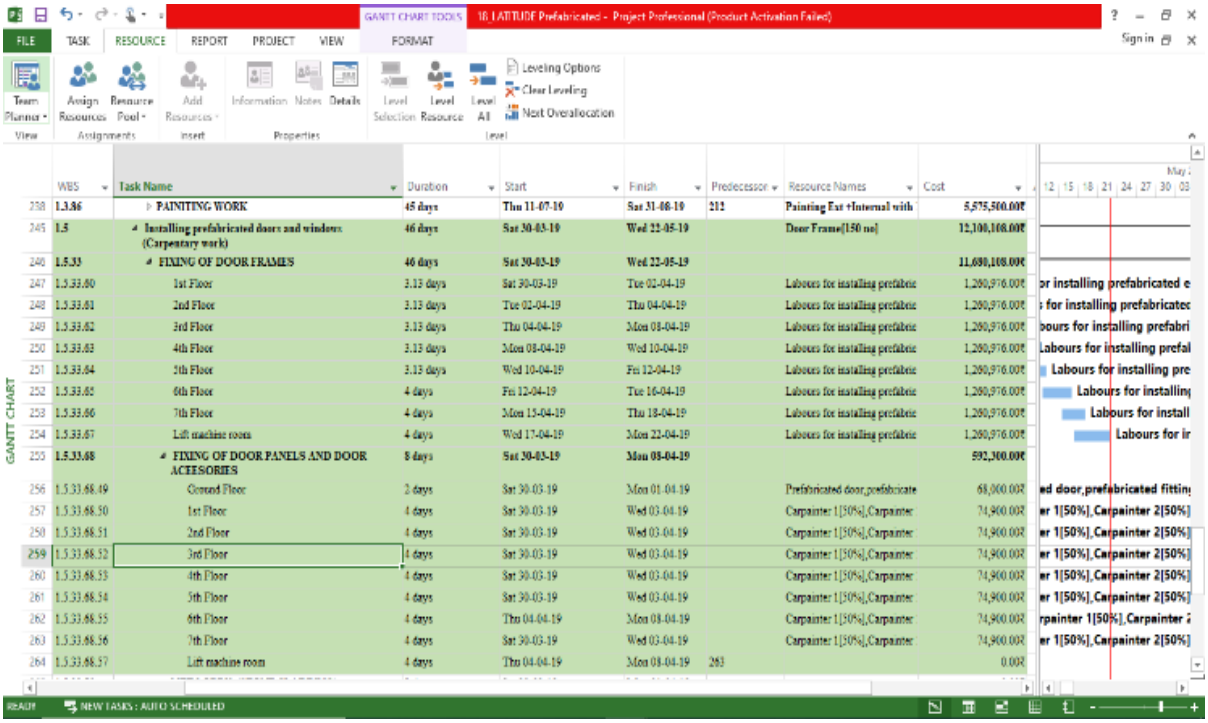
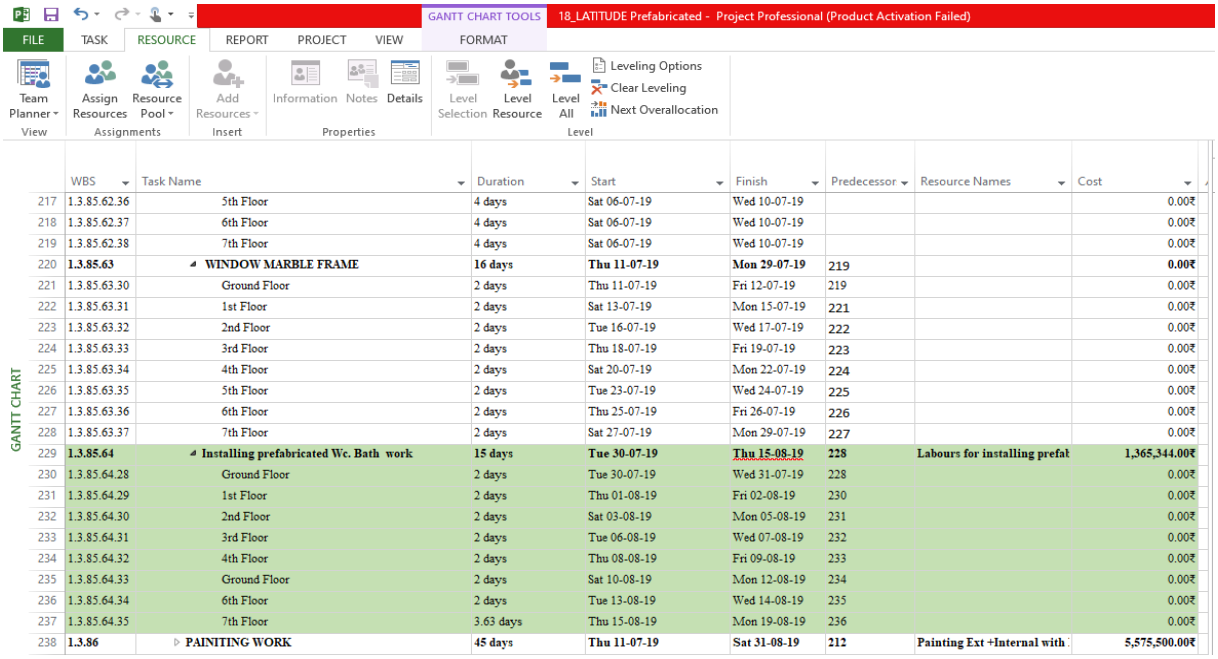
2. Prefabricated Door-windows frames.



	WBS	Task Name	Duration	Start	Finish	Predecessor	Resource Names	Cost
238	1.3.86	PAINITING WORK	45 days	Thu 11-07-19	Sat 31-08-19	212	Painting Ext +Internal with	5,575,500.00₹
245	1.5	Installing prefabricated doors and windows (Carpentary work)	46 days	Sat 30-03-19	Wed 22-05-19		Door Frame[150 no]	12,100,108.00₹
246	1.5.33	FIXING OF DOOR FRAMES	46 days	Sat 30-03-19	Wed 22-05-19			11,600,108.00₹
247	1.5.33.60	1st Floor	3.13 days	Sat 30-03-19	Tue 02-04-19		Labours for installing prefabric	1,260,976.00₹
248	1.5.33.61	2nd Floor	3.13 days	Tue 02-04-19	Thu 04-04-19		Labours for installing prefabric	1,260,976.00₹
249	1.5.33.62	3rd Floor	3.13 days	Thu 04-04-19	Mon 08-04-19		Labours for installing prefabric	1,260,976.00₹
250	1.5.33.63	4th Floor	3.13 days	Mon 08-04-19	Wed 10-04-19		Labours for installing prefabric	1,260,976.00₹
251	1.5.33.64	5th Floor	3.13 days	Wed 10-04-19	Fri 12-04-19		Labours for installing prefabric	1,260,976.00₹
252	1.5.33.65	6th Floor	4 days	Fri 12-04-19	Tue 16-04-19		Labours for installing prefabric	1,260,976.00₹
253	1.5.33.66	7th Floor	4 days	Mon 15-04-19	Thu 18-04-19		Labours for installing prefabric	1,260,976.00₹
254	1.5.33.67	Lift machine room	4 days	Wed 17-04-19	Mon 22-04-19		Labours for installing prefabric	1,260,976.00₹
255	1.5.33.68	FIXING OF DOOR PANELS AND DOOR ACESSORIES	8 days	Sat 30-03-19	Mon 08-04-19			592,360.00₹
256	1.5.33.68.49	Ground Floor	2 days	Sat 30-03-19	Mon 01-04-19		Prefabricated door,prefabricate	68,000.00₹
257	1.5.33.68.50	1st Floor	4 days	Sat 30-03-19	Wed 03-04-19		Carpainter 1[50%],Carpainter	74,900.00₹
258	1.5.33.68.51	2nd Floor	4 days	Sat 30-03-19	Wed 03-04-19		Carpainter 1[50%],Carpainter	74,900.00₹
259	1.5.33.68.52	3rd Floor	4 days	Sat 30-03-19	Wed 03-04-19		Carpainter 1[50%],Carpainter	74,900.00₹
260	1.5.33.68.53	4th Floor	4 days	Sat 30-03-19	Wed 03-04-19		Carpainter 1[50%],Carpainter	74,900.00₹
261	1.5.33.68.54	5th Floor	4 days	Sat 30-03-19	Wed 03-04-19		Carpainter 1[50%],Carpainter	74,900.00₹
262	1.5.33.68.55	6th Floor	4 days	Thu 04-04-19	Mon 08-04-19		Carpainter 1[50%],Carpainter	74,900.00₹
263	1.5.33.68.56	7th Floor	4 days	Sat 30-03-19	Wed 03-04-19		Carpainter 1[50%],Carpainter	74,900.00₹
264	1.5.33.68.57	Lift machine room	4 days	Thu 04-04-19	Mon 08-04-19	263		0.00₹

Fig 9: Work flow for Prefabricated Door-windows frames

3. Prefabricated Bathroom Unit With Toilet



	WBS	Task Name	Duration	Start	Finish	Predecessor	Resource Names	Cost
217	1.3.85.62.36	5th Floor	4 days	Sat 06-07-19	Wed 10-07-19			0.00₹
218	1.3.85.62.37	6th Floor	4 days	Sat 06-07-19	Wed 10-07-19			0.00₹
219	1.3.85.62.38	7th Floor	4 days	Sat 06-07-19	Wed 10-07-19			0.00₹
220	1.3.85.63	WINDOW MARBLE FRAME	16 days	Thu 11-07-19	Mon 29-07-19	219		0.00₹
221	1.3.85.63.30	Ground Floor	2 days	Thu 11-07-19	Fri 12-07-19	219		0.00₹
222	1.3.85.63.31	1st Floor	2 days	Sat 13-07-19	Mon 15-07-19	221		0.00₹
223	1.3.85.63.32	2nd Floor	2 days	Tue 16-07-19	Wed 17-07-19	222		0.00₹
224	1.3.85.63.33	3rd Floor	2 days	Thu 18-07-19	Fri 19-07-19	223		0.00₹
225	1.3.85.63.34	4th Floor	2 days	Sat 20-07-19	Mon 22-07-19	224		0.00₹
226	1.3.85.63.35	5th Floor	2 days	Tue 23-07-19	Wed 24-07-19	225		0.00₹
227	1.3.85.63.36	6th Floor	2 days	Thu 25-07-19	Fri 26-07-19	226		0.00₹
228	1.3.85.63.37	7th Floor	2 days	Sat 27-07-19	Mon 29-07-19	227		0.00₹
229	1.3.85.64	Installing prefabricated Wc. Bath work	15 days	Tue 30-07-19	Thu 15-08-19	228	Labours for installing prefab	1,365,344.00₹
230	1.3.85.64.28	Ground Floor	2 days	Tue 30-07-19	Wed 31-07-19	228		0.00₹
231	1.3.85.64.29	1st Floor	2 days	Thu 01-08-19	Fri 02-08-19	230		0.00₹
232	1.3.85.64.30	2nd Floor	2 days	Sat 03-08-19	Mon 05-08-19	231		0.00₹
233	1.3.85.64.31	3rd Floor	2 days	Tue 06-08-19	Wed 07-08-19	232		0.00₹
234	1.3.85.64.32	4th Floor	2 days	Thu 08-08-19	Fri 09-08-19	233		0.00₹
235	1.3.85.64.33	Ground Floor	2 days	Sat 10-08-19	Mon 12-08-19	234		0.00₹
236	1.3.85.64.34	6th Floor	2 days	Tue 13-08-19	Wed 14-08-19	235		0.00₹
237	1.3.85.64.35	7th Floor	3.63 days	Thu 15-08-19	Mon 19-08-19	236		0.00₹
238	1.3.86	PAINITING WORK	45 days	Thu 11-07-19	Sat 31-08-19	212	Painting Ext +Internal with	5,575,500.00₹

Fig 10: Costing Of Prefabricated Bathroom Unit With Toilet

Result from WBS of Prefabricated Construction from MSP is:

- No. of days – 862 days
- Cost with material+labour+ transportation and Machinery- 29,827,069.00₹

Table no. 3: Result from WBS of Prefabricated Construction

No. of days	862
Cost (Rs)	29,827,069.00

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Comparison of conventional construction to prefabrication construction case study

Table no. 4: Comparison

Type	Duration(Days)	Cost(Rs.)
Conventional Construction	1097	30,265,585.00
Prefabrication Construction	862	29,827,069.00

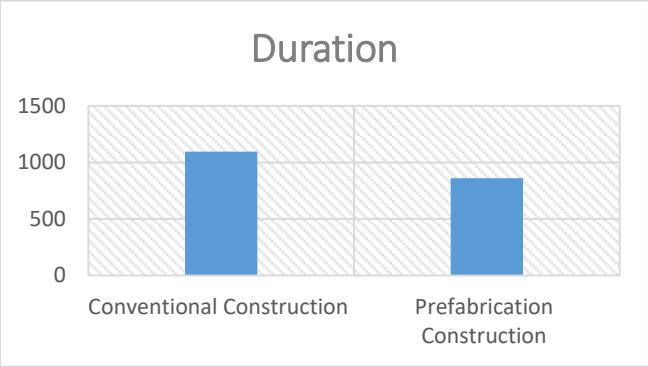

Fig 11: Comparison of Duration for Conventional Construction To Prefabrication Construction

The fig. No. 11 shows the comparison between conventional construction and prefabrication construction for duration respectively as 1097 and 862 days.

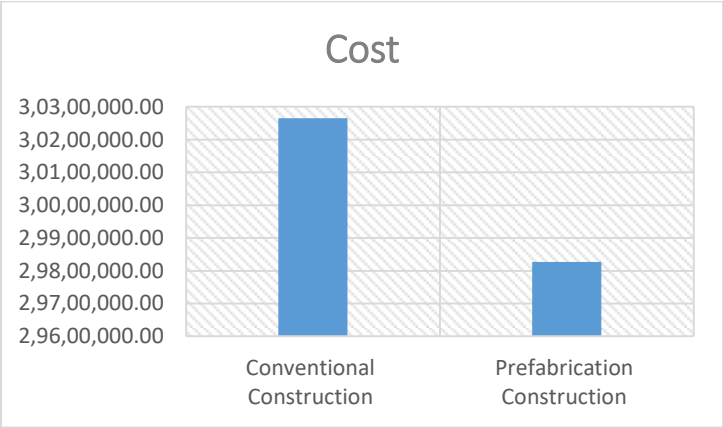

Fig 12: Comparison of Cost for Conventional Construction to Prefabrication Construction

The fig. no. 12 shows the comparison for cost in between conventional construction and prefabrication construction respectively as 3,02,65,585.00/- and 2,98,27,069.00/- Which means we are saving 4,38,516.00/- Rs from the convectional structure by making it a prefabricated one.

The cost of Prefabrication construction is slightly increased as the transportation has increased and fitting charges are included

IV. CONCLUSION

1) The comparative survey of conventional construction with prefabricated construction found that conventional construction requires 3.02 Cr rupees & 1097 days to complete construction while 2.98 Cr rupees & 862 days required for prefabrication construction which shows that prefabrication process reduces time and cost required to construction for completion.

2) By changing parts of RCC building with prefabricated parts like prefabricated walls, w/c, bath, doors & window frames we come to conclusion that prefabrication construction reduces time as well as cost required to project for completion and it can be successfully applied on the construction site.

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