

**Term-Project Report**  
**CE401L-Estimation and Construction Management**  
Estimation and construction-activity scheduling of Health Center-IIT Tirupati

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# 1 Introduction

## 1.1 Problem Statement

- To estimate the probable construction cost of the Health Centre at IIT Tirupati satisfying requirements imposed by provided architectural and structural drawings. The costing is to be performed based on the costs suggested by the Delhi Schedule of Rates
- To prepare an optimal sequence plan for the construction of the assigned building.

# 2 Estimation of Construction Costs

## 2.1 Earthwork

Earthwork refers to engineering activities involving reshaping a site's terrain by digging deep, moving large quantities of earth or rock, and cutting and filling soil as per the approved drawings. (The cost of site-clearing is also loaded into this subhead)

### 2.1.1 Estimation of earthwork quantity

As per the drawings cutting activities are only required for footing construction, filling is to be performed till the F.G.L provided in the drawing. Based on the reported design safe bearing capacity of  $200KN/m^2$ , the soil is considered dense and predominantly granular.

The summary of necessary earthwork volume requirements is provided in Table-1, for detailed calculation refer to the Excel sheet titled "Earthwork.xlsx". The site area of the project is around  $961.6m^2$ .

### 2.1.2 Cost Estimation of Earthwork activities

The total cost accounted for earthwork is **₹11,13,500**. The detailed breakdown for the earthwork sub-head is provided below.

- Cost of  $1m^3$  of earthwork(for depth exceeding 30cm, width exceeding 1.5m) is ₹177.523 (Clause 2.6.1-DSR-I-2023). The estimated cost for excavation work involved in this project would amount to **₹2,64,120**.
- Cost of  $1m^3$  of filling(in layers of maximum thickness 20cm) is ₹195.99 (Clause 2.25-DSR-I-2023). The estimated cost for filling activities(except plinth levelling) involved in this project would amount to **₹1,55,642**.
- Cost of  $1m^3$  of filling in plinth layer is ₹2123.75 (Clause 2.27-DSR-I-2023). The estimated cost for filling in the plinth region (with adequate watering, ramming, consolidation and dressing) would amount to **₹2,84,770**.
- For proper disposal(including stalking, transport, filling, ramming and watering) of  $1m^3$  of unrealized excavated material(assumed to be disposed within 5KM) the cost incurred is expected to be ₹700.5 (Clause 2.25(a)-DSR-I-2023). The total cost for disposal would amount to **₹3,91,993**.

Description	Footing Type	Excavation Volume( $m^3$ )	Filling Volume( $m^3$ )
Excavation of footings	Isolated-Footing	631.47	-
	Strip-Footing	319.89	-
Filling of excavated footing space till F.G.L	Isolated-Footing	-	646.63
	Strip-Footing	-	147.50
Leveling Plinth region	-	536.45	134.09
	Total	<b>1487.80</b>	<b>928.22</b>

Table 1: Summary of Earthwork calculation

- The cost of clearing 1m<sup>2</sup> of area(assumed jungle) is —17.6(Clause 2.3.1-DSR-I-2023). The total cost of site clearing would amount to **₹17,000**.

## 2.2 Masonry-work

Masonry work refers to the craft of building structures with brick, stone or other materials. Masonry units have to be properly placed, aligned and plastered with appropriate PCC to ensure bonding between elements.

### 2.2.1 Estimation of Masonry quantity

The masonry requirement is computed by accounting for the volume of masonry units required as per the layout provided in the drawings. Appropriate deductions and additions are made for miscellaneous items(stairs, openings). For a detailed description refer to the Excel sheet titled "Masonry.xlsx". The masonry requirements for each floor are summarized in Table-2.

### 2.2.2 Cost Estimation of Masonry work

The cost of 1m<sup>3</sup> of earthwork including the costs of the adhesive motor is expected to be ₹8333.65 (Clause 6.47-DSR-I-2023). The cost for masonry works in the project is expected to be **₹26,37,200**.

## 2.3 Concrete works

Concrete work accounts for all work germane to concrete. The associated cost for concrete work accounts for costs including raw materials, mixing, shuttering, centring, placement, vibration, curing, form work-stripping and labour to perform necessary tasks.

Masonry Requirement	Masonry Volume(m <sup>3</sup> )
between G and G+1 floors	112.25
between G+1 floor and roof	175.26
Parapet walls	28.95
Total	<b>316.45</b>

Table 2: Summary of Masonry calculation

Description	Volume of Concrete(m <sup>3</sup> )	Volume of Plaster (m <sup>3</sup> )	Surface area required for formwork(m <sup>2</sup> )
Footings	264.777	93.5685*	98.58
Columns	186.22	25.74	211.38
Beams-Plinth	50.35	8.78	585.57
Beams-G+1	97.10	14.41	960.47
Beams-Roof	76.61	11.27	751.23
Slabs-G floor	148.82	14.88	1984.26
Slabs-G+1 floor	76.83	14.45	963.54
Roof Slabs	49.45	10.21	680.40
Miscellaneous-First -floor store room	27.93	5.76	383.73
Miscellaneous-Staircase	2.77	0.52	34.75
Miscellaneous-Structure -supporting Water Tank	5.34	0.81	68.55
Total	<b>721.43</b>	<b>106.83</b>	<b>6623.86</b>

Table 3: Summary of concrete works

### **2.3.1 Estimation of Concrete-works**

The quantity of concreting works is calculated by accounting for the volume of reinforced cement concrete, the volume of concrete used for plastering and the surface area of formwork required for shuttering. The summary of the quantity of concrete works is listed in Table-3. For a detailed description refer to the Excel sheet titled "ConcreteWorks.xlsx".

It is to be noted that only M35 concrete is used in all RCC members.

### **2.3.2 Cost Estimate of concrete works**

The total cost accounted for concrete works is approximately **₹1,34,72,500**. The detailed breakdown for this particular sub-head is provided below.

- Cost of  $1m^3$  of M35 concrete(inclusive of costs associated to raw materials, admixtures, transportation, placement, vibrating, curing and labour) is ₹9806.7(Clause 5.33.1.3-DSR-I-2023). The estimated cost for works involving M35 concrete in this project would amount to **₹70,74,850**.
- Cost of shuttering and centring  $1m^2$  of the concrete surface in footing and retaining walls is expected to cost ₹392.15 and ₹842.5 respectively(Clause 4.3.1,4.3.2-DSR-I-2023), the cost of formwork for footing is **₹24,110** and **₹31,300**.
- Cost of shuttering and centring  $1m^2$  of the concrete surface in columns is expected to cost ₹961.3(Clause 4.3.3-DSR-I-2023), the expected cost of formwork for columns is **₹2,03,200**.
- Cost of shuttering and centring  $1m^2$  of the concrete surface in beams is expected to cost ₹736.4(Clause 5.9.5-DSR-I-2023), the expected cost of formwork for beams is **₹16,91,700**.
- Cost of shuttering and centring  $1m^2$  of the concrete surface in floors/slabs is expected to cost ₹927.25(Clause 5.9.6-DSR-I-2023), the expected cost of formwork for beams is **₹37,83,700**.
- Cost of shuttering and centring  $1m^2$  of the concrete surface in stairs is expected to cost ₹764.95(Clause 5.9.7-DSR-I-2023), the expected cost of formwork for beams is **₹26,600**.
- For PCC(1:4:8) layer below footings, Cost of  $1m^3$  of PCC(1:4:8) is expected to be ₹6812(Clause 4.1.8-DSR-I-2023), the entire cost required for plastering amounts to **₹6,37,400**.

## **2.4 Reinforcement for RCC members**

The costs ascribed to this subhead account for R.C.C. work including straightening, bending, cutting and placement of rebars.

### **2.4.1 Estimation of reinforcement requirements**

The reinforcement requirement is computed by accounting for the total mass of steel rebars required. The bar bending schedule is appropriately subdivided and accordingly prepared based on bar bending specifications suggested by IS-456. The summary of the quantity of reinforcement requirement is listed in Table-. For a detailed description refer to the Excel sheet titled "Reinforcement.xlsx". A summary of reinforcement requirements is displayed in Table-4.

### **2.4.2 Bar-Bending Schedule for footings**

The bar-bending schedule for footings is listed in Table-5, It is to be noted that for bar lengths exceeding 6000mm, the bars are accounted to be broken and spliced with suitable development lengths.

### **2.4.3 Bar-Bending Schedule for Columns**

The bar-bending schedule for columns is listed in Table-6, It is to be noted that for bar lengths exceeding 6000mm, the bars are accounted to be broken and spliced with suitable development lengths. For the bar bending schedule for stirrups refer to the sheet titled "Columns" in the Excel sheet titled "Reinforcement" along with structural drawing-2.

#### 2.4.4 Bar-Bending Schedule for slabs/beams

For the bar-bending schedule of other RCC members, the bend detailing is to be obtained from structural drawings and the number of bars can be obtained from an Excel sheet titled "Reinforcement.xlsx", It is to be noted that for bar lengths exceeding 6000mm, the bars are accounted to be broken and spliced with suitable development lengths.

The images of bar bending pattern for a few select basic bar types is presented in Fig-1. For detailed drawings refer to appropriate structural drawings.

Steel Reinforcement Requirement-Summary		
<b>Footings</b>	Longitudinal Reinforcement	5979.03
<b>Columns</b>	Longitudinal Reinforcement	12381.37
<b>Columns</b>	Lateral Ties	3273.34
<b>Plinth and Grade Beams</b>	Longitudinal Reinforcement	3970.94
<b>Plinth and Grade Beams</b>	Lateral Ties	1943.26
<b>Beams(G+1)</b>	Longitudinal Reinforcement	6846.26
<b>Beams(G+1)</b>	Lateral Ties	2692.47
<b>Beams(G+2)</b>	Longitudinal Reinforcement	6761.92
<b>Beams(G+2)</b>	Lateral Ties	2233.18
<b>Slabs-G floor</b>	Longitudinal Reinforcement	8757.83
<b>Slabs-G+1 floor</b>	Longitudinal Reinforcement	7241.80
<b>Slabs-G+2 floor</b>	Longitudinal Reinforcement	6137.92
<b>Miscallaneous- Slabs-First floor common room</b>	Longitudinal Reinforcement	1572.25
<b>Miscallaneous-Water Tank</b>	Longitudinal Reinforcement	312.60
	Total(kg)	<b>70104.17</b>

Table 4: Summary of Reinforcement Requirement for RCC members

Footings						
S.No	L(mm)	a(mm)	Rebar Type	Bar Dia(mm)	Number of bars	Bar Type
1	3100	550	FE 500	12	28	A
2	2700	550	FE 500	12	43	A
3	2400	550	FE 500	12	19	A
4	2400	550	FE 500	12	33	A
5	1700	550	FE 500	12	11	A
6	1400	550	FE 500	10	13	A
7	1800	550	FE 500	10	26	A
8	1700	550	FE 500	10	26	A
9	1400	550	FE 500	10	118	A
10	1900	550	FE 500	10	232	A
11	3200	550	FE 500	12	56	A
12	4900	550	FE 500	10	173	B

Table 5: Bar-Bending Schedule for footings

Column-Longitudinal Reinforcement						
S.No	L(mm)	A(mm)	Rebar Type	Bar Dia(mm)	Number of bars	Bar Type
1	5550	450	FE 500	25	312	B
2	5550	450	FE 500	20	268	B
3	5550	450	FE 500	32	60	B
4	5550	450	FE 500	16	132	B

Table 6: Bar-Bending Schedule for Columns(Longitudinal)

ID in Drawings	Description	Number of bars	Length of each	Mass of steel
SB4	ISMC-300 Box	8	5860	1668.89
SB3	RHS 300 × 150 × 6mm	16	5860	4335.31
SB1	RHS 120 × 60 × 3.6	6	2425	236.96
SHS	RHS 150 × 150 × 5	16	6000	2208.96
SB2	RHS 200 × 100 × 5		#Refer STR-12	3759.83
P1	RHS 100 × 50 × 3.2	16	10970	1985.13
P2	RHS 80 × 40 × 3.2	144	2425	3132.32
			Total	<b>17327.42kg</b>

Table 7: Summary of Steel-works

#### 2.4.5 Cost Estimate of Reinforcement associated works

The total cost accounted for reinforcement in RCC members is approximately **₹69,87,000**. The detailed breakdown for this particular sub-head is provided below.

- Cost of 1Kg of thermo-mechanically treated FE500D bars (inclusive of costs associated with cutting, bending, placing and binding) is ₹99.65(Clause 5.22.B.1-DSR-I-2023).

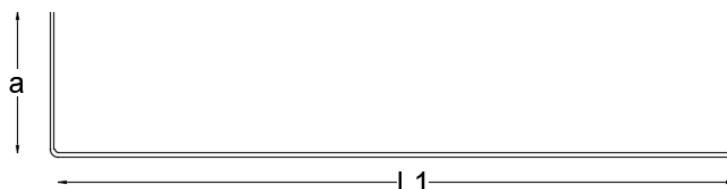
#### 2.5 Steel-Works

The subhead includes costs of all steel-related work(except reinforcement), the cost includes cost for cutting, welding/bolting/riveting, hoisting, placement and primer coating of the structural steel. The schedule of steel sections is reported in Table-7. For detailed description refer to the Excel sheet titled "Steelwork.exe".

##### 2.5.1 Cost Estimate of Steel-works

The total cost accounted for steel works in the structure is approximately **₹23,17,000**. The detailed breakdown for this particular sub-head is provided below.

- Cost of steel-work for 1 m of steel ( cutting, welding/bolting/riveting, hoisting, placement and primer coating) is ₹133.70(Clause 10.2-DSR-I-2023).



(a) Bent Bar-Type A



(b) Bent Bar-Type B

Figure 1: Drawing depicting common bar bending works

ID	ED	MD	D	DA	D1	D2	D3	D4	D4A	D5	D6	W	W1	W2	W3	W4	V	V1	V2
<b>nos</b>	2	<b>8</b>	4	1	4	4	2	4	2	16	6	8	1	5	2	13	5	4	4

Table 8: Schedule of joinery (Description of product ID provided in STR-01)

## 2.6 Flooring work

The floor work accounts for all activities related to tiles including procurement cost of tiles, labour cost and cost for pointing.

### 2.6.1 Cost Estimate of Flooring works

The surface area of flooring work on each floor is calculated and skirting along with dodooing works are then accounted for walls and stairs. The total cost accounted for reinforcement in RCC members is approximately ₹22,00,500. The detailed breakdown for this particular sub-head is provided below

- The total floor area requiring tiling on the Ground and first floor is  $1388.72m^2$ (refer to "Concreetworks.xlsx"). Assuming vitrified tiles of  $2'' \times 2''$ , vitrified tiles would require ₹1553.46 per  $m^2$ (Clause 11.41.2-DSR-I-2023).
- Assuming the daddoing and skirting area to be 0.5% of the total tiling area, the area to be daddoed would amount to  $6.94m^2$ . The cost per  $m^2$  of work amounts to ₹1475.35(Clause 11.22-DSR-I-2023).
- The surface area of tiling in stair is  $22.29m^2$ (refer "Concreetworks.xlsx"). The cost for tiling in stairs amounts to ₹1475.35(Clause 11.22-DSR-I-2023).

## 2.7 Roofing work

Roofing work refers to activities involving installing any covering for decorative or weatherproofing reasons above a floor.

### 2.7.1 Estimation of Roofing works

The roofing work includes the installation of the false ceiling(Note false ceiling is not required for restrooms and storerooms), The total area which is to be false ceiled is  $933.24m^2$ (Refer "Concreetworks.xlsx"). The surface area of the roof is  $922.16m^2$ .

### 2.7.2 Cost Estimate of Roofing works

The total cost accounted for roofing works is approximately ₹15,62,000. The detailed breakdown for this particular sub-head is provided below

- The cost of providing and fixing false ceiling is ₹1355.8 per  $m^2$ (Clause 12.45.1-DSR-I-2023).
- Thermal insulation of roofing with expanded polystyrene is accounted as ₹321.75 $m^2$ (Clause 11.22-DSR-I-2023).

## 2.8 Procurement of fabricated components

The fabricated components include glass panels, doors and windows. The number of components to be procured for each part is listed in Table-8. The cost of these products along with other sanitary equipment is accounted for in functional costs.

## 2.9 Finishing works

Finishing works include the costs for plastering, pointing and painting exposed surfaces.

### **2.9.1 Estimation of finishing works**

The surface area of finishing work is estimated from the volume of masonry required(as the average thickness of the brick structure is approximated). The surface area of the masonry is approximately  $316.45/(2/3 \times .200 + .100/3) = 1900.25m^2$ . Of which approximately  $1/3^{rd}$  of the surface is exposed (The numbers are based on data listed in "Masonry.xlsx"). The cost of finishing work of structural parts has been accounted for in the concrete works subhead.

### **2.9.2 Cost Estimate of finishing works**

The total cost of finishing works is ₹3,77,000. The detailed breakdown is provided below.

- The cost of interior finishing(new structure with 2 coatings and paint work) per  $m^2$  is ₹185.65(Clause 13.41.1-DSR-I-2023).
- The cost of interior finishing(new structure with 2 coatings, additional primer coating and paint work) per  $m^2$  is ₹223.60(Clause 13.45.1-DSR-I-2023).

## **2.10 Cumulative cost of construction**

The total cost of the construction project is stated in Table-9 along with the summary of the various subheads. The percent wise breakdown of costs is reported in Figure-2. Few assumptions are being made about the cost of non-civil or non-structural costs including but not limited to architectural/functional costs(wooden panels in classrooms, pergolas, procurement of fabricated components, sanitary), plumbing and electrical costs. The assumptions are stated below.

- The cost of the architectural works intended for functional(non-structural purpose) has been assumed to cost 15% of the entire project cost.
- The cost of plumbing works is assumed to be 8% of the project cost.
- The cost of electrical works is assumed to be 8% of the entire project cost

The cumulative cost of the project inclusive of contractor profits is ₹4,44,20,000. The plinth area of the building is  $711.04m^2$ . Thus the plinth area rate of the building is 62472 ₹/ $m^2$  or 5803.83 ₹/ $sq.ft$

The costs are validated by comparing them with a rough estimate of costs derived through plinth rates. The cost estimate obtained from the plinth area rate amounts to ₹4,05,95,000 The breakdown is presented in table-10. (It is to be noted that the plinth estimates are approximate and do not take in specialized components included in the calculated cost) The plinth area estimate is performed based on rates specified in "CPWD Plinth Area Estimates-2023".

Cumulative Cost Estimate		
S.No	Sub-head	Cost
1	Earth-work	₹11,13,500
2	Masonry-work	₹26,37,200
3	Concrete-work	₹1,34,72,500
4	Reinforcement Costs	₹69,87,000
5	Steel-works	₹23,17,000
6	Flooring-works	₹22,00,500
7	Roofing works	₹15,62,000
8	Finishing-works	₹3,77,000
9	Architectural-works(Including pergolas, procurement of fabricated components, etc)	15% of project cost
10	Plumbing-works	8% of project cost
11	Electrical works	8% of project cost
Total		₹4,44,20,000

Table 9: Calculated cumulative cost of project

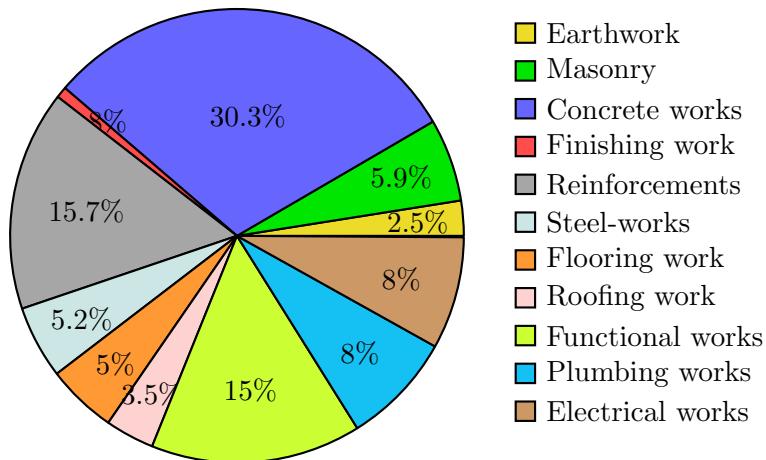


Figure 2: Breakdown of costs

Approximate cost through plinth rate estimates			
Description	Cost per unit area	Area	Total
RCC framed structure	₹26,120.00	711.04	₹1,85,72,365
Basement Floor	₹23,610.00	711.04	₹1,67,87,654
Fire fighting+ Fire-alarm	₹1,060.00	711.04	₹7,53,702
Internal water and sanitary applications	5.00%	-	₹9,28,618
Electrical	3.75%	-	₹6,96,464
Electrical Insulation	12.50%	-	₹23,21,546
Approval for tree cutting	1.25%	-	₹2,32,155
Water tank	23 per litre	13,150 litre capacity	₹3,02,496
		Total	₹4,05,95,000

Table 10: Plinth area estimate of project cost

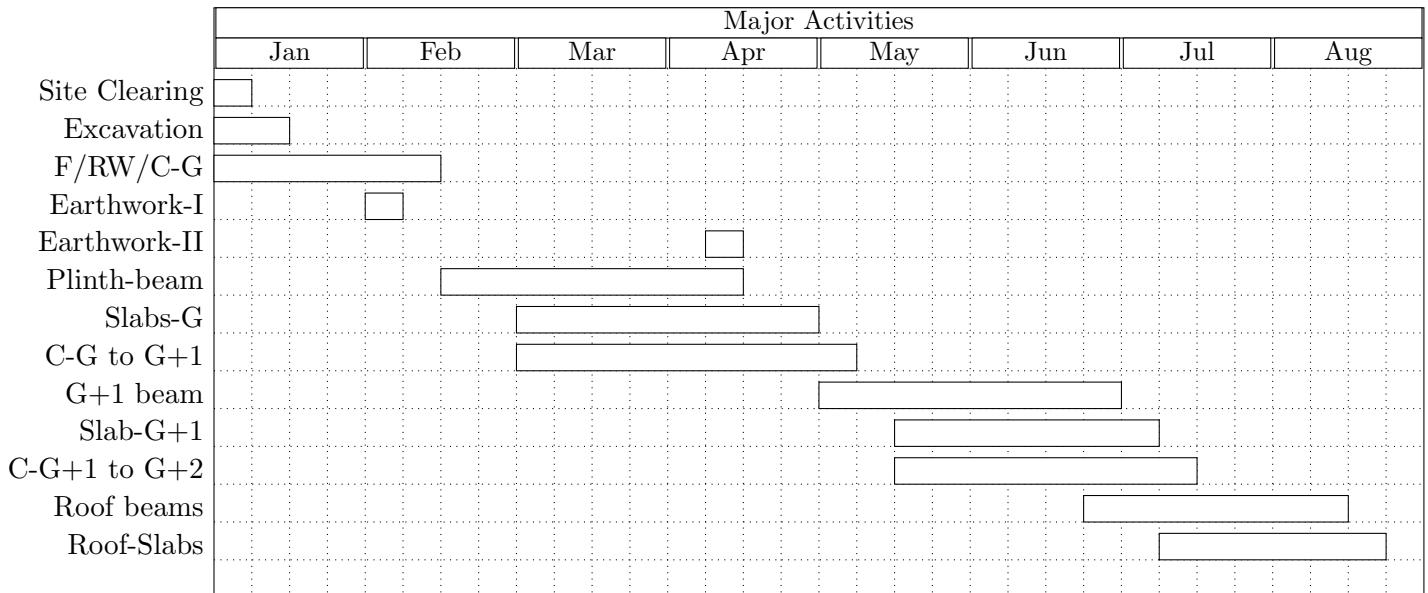


Figure 3: Summary of Project work(For detailed chart refer to submitted Gantt chart)

### 3 Planning and Scheduling of Construction activities

Scheduling in construction projects (the process of listing tasks, activities, and milestones with a planned start and finish date) is paramount to a project's success. Proper scheduling is required to ensure the completion of the project within a specified time and while satisfying budget constraints. On the basis of efficient resource allocation and progress monitoring a schedule breakdown is prepared along with the labour requirement chart and is presented in Table-11. This duration does not include the dates for localizing labour or equipment, the project start is assumed to start with all resources procured and available at the site.

#### 3.1 Gantt Chart

The Gantt chart for the project is prepared and submitted both as an Excel workbook titled "Health Center IIT-Tirupati-CE401L-Term project.xlsx" and a Microsoft Project workbook is created under the following public domain name "Health Center IIT-Tirupati-CE401L-Term project" ([link](#)). Note-The project start is assigned as "01-01-2024".

#### 3.2 Critical Path Analysis of construction schedule

Critical path analysis is performed for the construction schedule and is presented in the following [link](#).

#### 3.3 Summary of construction schedule

The predicted project duration is around **272 days** with expected optimized project duration as **218** days as per Microsoft Project. In this work the optimized schedule is not considered and all reported data is for the prepared schedule(as Microsoft Project trail features do not allow for optimization)). A rough Gantt chart approximately listing the major works in the project is listed in Fig-3

Schedule Breakdown			No of workers required for the activity								
S.No	Activity	Breakdown of activity	Duration	Mason	Blacksmith	Beldar	Bhisti	Coolie	Mate	Fitter	Painter
1	Site Cleaning	Site Clearing	5	0	0	2	0	1	0	0	0
1.1											
2	Excavation	Cutting upto base level of footing	6	0	0	0	0	1	1	0	0
2.1											
2.2		Filling and compacting sand layer	2	0	0	4	5	1	0	0	0
3	Footing/Retaining walls/Columns-G	Laying PCC	5	2	0	3	13	0	0	0	0
3.1											
3.2		Footing Reinforcement Bending	10	0	11	11	0	0	0	0	0
3.3		Reinforcement Placement	5	0	13	13	0	0	0	0	0
3.4		Formwork Placement for column	5	0	0	5	0	0	0	2.5	0
3.5		Concrete placement	2	3	0	32	16	0	0	0	0
3.6		Concrete Curing	28								
3.7		Removal/Stripping of Formworks	2								
4	Earthwork	Filling upto Plinth level	5	0	0	14	17	6	0	0	0
4.1											
5	Plinth Beam	Reinforcement bending and assembly	7	0	14	14	0	0	0	0	0
5.1											
5.2		Placement of formworks	5	0	0	3	0	0	0	1	0
5.3		Concrete placement	2	0	0	5	2	0	0	0	0
5.4		Concrete Curing	28								
5.5		Removal/Stripping of Formworks	2								
6	Slabs-G	Reinforcement bending and assembly	10	0	14	14	0	0	0	0	0
6.1											
6.2		Placement of formworks	5	0	0	3	0	0	0	1	0
6.3		Concrete placement	2	1	0	15	7	0	0	0	0
6.4		Curing	28								
6.5		Removal/Stripping of Formworks	2								
7	Columns-G to G+1	Reinforcement bending and assembly	10	0	8	8	0	0	0	0	0
7.1											
7.2		Placement of formworks	5	0	0	2	0	0	0	1	0
7.3		Concrete placement	2	0	0	6	3	0	0	0	0
7.4		Curing	28								
7.5		Removal/Stripping of Formworks	2								
8	G+1-Beam	Placement of Scaffoldings	4								
8.1		Reinforcement bending and assembly	10	0	15	15	0	0	0	0	0
8.2											
8.3		Placement of formworks	5	0	0	3	0	0	0	1	0
8.4		Concrete placement	2	0	0	5	2	0	0	0	0
8.5		Curing	28								
8.6		Removal/Stripping of Formworks	2								

Schedule Breakdown		No of workers required for the activity					
9	G+1-Slabs	Placement of Scaffoldings	4				
9.1		Reinforcement bending	10	0	14	14	0
9.2		and assembly				0	0
9.3		Placement of formworks	5	0	0	3	0
9.4		Concrete placement	2	1	0	15	7
9.5		Curing	28				
9.6		Removal/Stripping of Formworks	2				
10	Columns-G+1 to roof	Reinforcement bending and assembly	10				
10.1		Placement of formworks	5	0	16	16	0
10.2		Concrete placement	2	0	0	15	0
10.3		Curing	28	0	0	0	0
10.4		Removal/Stripping of Formworks	2				
10.5		Removal of Scaffoldings	4				
11	Roof-Beam	Placement of Scaffoldings	4				
11.1		Reinforcement bending and assembly	10	0	14	14	0
11.2		Placement of formworks	5	0	0	2	0
11.3		Concrete placement	2	1	0	8	3
11.4		Curing	28				
11.5		Removal/Stripping of Formworks	2				
11.6		Placement of Scaffoldings	4				
12	Roof-Slabs	Reinforcement bending and assembly	10	0	11	11	0
12.1		Placement of formworks	5	0	0	2	0
12.2		Concrete placement	2	1	0	7	3
12.3		Curing	28				
12.4		Removal/Stripping of Formworks	2				
12.5		Placement of Scaffoldings	4				
12.6		Reinforcement bending and assembly	10	0	1	1	0
13	Walls/Floating columns	Placement of formworks	5	0	0	1	0
13.1		Concrete placement	2	0	0	1	0
13.2		Curing	28				
13.3		Removal/Stripping of Formworks	2				
13.4		Placement of Scaffoldings	4				
13.5		Reinforcement bending and assembly	10	0	3	3	0
13.6		Placement of formworks	5	0	0	1	0
13.7		Concrete placement	2	0	0	5	2
13.8		Curing	28				
13.9		Removal/Stripping of Formworks	2				
14	Stairs	Reinforcement bending and assembly	10	0	3	3	0
14.1		Placement of formworks	5	0	0	1	0
14.2		Concrete placement	2	0	0	1	0
14.3		Curing	28				
14.4		Removal/Stripping of Formworks	2				
14.5		Placement of Scaffoldings	4				
15	Masonry	Reinforcement bending and assembly	10	0	3	3	0
15.1		Placement of formworks	5	0	0	1	0
15.2		Concrete placement	2	0	0	5	2
15.3		Curing	28				
15.4		Removal/Stripping of Formworks	2				
15.5		Placement of Scaffoldings	4				

Schedule Breakdown		No of workers required for the activity					
15.1	b/w G and G+1	15	5	0	0	22	0
15.2	b/w G+1 and roof	15	8	0	0	35	0
15.3	Parapet walls	15	1	0	0	6	0
16	Steel works						
16.1	Cutting and assembly of steel components as per drawings	5	-	3	8	-	-
16.2	Placement and connection of steel components						2
16.3	Integration of assembly with the building						-
17	Flooring works						
17.1	Procurement of tiles						
17.2	Placement of floor tiles with mortar	20	17	0	0	0	0
17.3	Skirting and daddling	2	9	0	0	0	0
18	Finishing works						
18.1	Plastering/pointering/painting-G	8	0	0	0	12	0
	Plastering/pointing/painting-G+1	8	0	0	0	8	0
	Plastering/pointing/painting-G+2	8	0	0	0	4	0
19	Roofing works						
19.1	Thermal insulation of roof	10	0	0	3	0	0
19.2	Installation of false-ceiling	10	0	2	0	0	0
20	Functional works						
20.1	Procurement of fabricated components						
20.2	Procurement of Sanitary Components(doors, windows)						
20.3	Installation of Fabricated components						
20.4	Installation of Sanitary Components						
20.5	Architectural works on structure						
21	Plumbing works						
22	Electrical works						

## **4 Conclusion**

In this work, the cost involved in the construction of the Health Center at IIT Tirupati is estimated and a suboptimal sequence of construction activities is prepared and detailed.

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