Cost Estimation and Specification of a Sewage Treatment Plant at BIT campus

Shobhan Majumder ¹, Poornesh ², Reethupoorna M.B. ², Razi Musthafa ²
Assistant Professor, Dept. of Civil Engineering, B.I.T, Mangaluru, India¹
Research Scholar, Dept. of Civil Engineering, B.I.T, Mangaluru, India²

ABSTRACT: The focus of present study is to identify the cost estimation and specification of various treatment units in a Sewage Treatment Plant (STP) at Bearys Institute of Technology (BIT). The contours of the ground were found to be higher at South West direction (100.5 m) and lowest at North East direction (92.5 m), expected a gravity flow in this direction. The estimation of the proposed structure is particularly essential to distinguish all of the expense for the proposed units to be constructed. The treatment units were designed based on daily sewage generation. Total cost of construction for Equalization tank was estimated as Rs. 65597 with Flash mixer of Rs. 16397. However, total estimated cost of construction of STP was calculated as Rs. 839281.

KEYWORDS: Cost estimation, Specification, STP, Treatment units.

I. INTRODUCTION

The aim of wastewater treatment is to ensure human health and prevent ecological degradation by the safe disposal of local and modern wastewater generated during the utilization of water [1]. In India, there was no particular treatment given to wastewater and was discharged into drains and trenches, which in the long run wound up in waterways, streams, lakes, and seas, and eventually utilized by individuals[2]. Incorporating the cost estimation and cost control is accomplished by utilizing the social database the executive’s framework in Microsoft Access. Therefore, such coordination empowers the exchange of cost estimation information naturally to the cost control process [3]. The major conclusion is that cost invaded in structure development is as yet an unfriendly issue because of different known reasons and in this way, there is an earnest requirement for building up a propelled expense in structure development that should yield better outcome [4]. Supporting of these models that depend on verifiable information, fake neural systems and case-based thinking techniques achieve an acceptable level of error. By far most of strategies don't consider, since the factors that depend on the possibility of practical advancement [5].

II. SITE SURVEYING

Bearys Institute of Technology (BIT) is 20 km from the centre of the city and 5 km from Mangalore University Campus at Konaje. The campus is having 5-acre area, consists of two academic blocks, one workshop block and two hostels with a mess and one prayer hall. The plan and the contours of the Bearys Institute of Technology campus represented in Fig 1 and Fig 2, respectively. The blocks totally consist of seven water tanks of 5000 liters capacity each with 3 times loading per day, so total capacity of 105000 liters of water are pumped daily. In the present study two overhead tanks (OHTs) have been considered which are placed on boy’s hostel and the STP was designed for the generated sewage from the same. Therefore, the total quantity of water required for the boy’s hostel is 30000 liters per day. From the contour map of the campus it was observed that, South West part of the campus is of higher elevation and North East is of lower elevation where we can expect the gravity flow. So, placing the STP in North East is more convenient. The contour values were varying from 91.5 m to 92.5 m in the proposed sewage treatment plant area.
III. CALCULATION OF WASTEWATER GENERATED

**INPUT**

<table>
<thead>
<tr>
<th>No. of water tanks</th>
<th>Each tank capacity</th>
<th>No. of times of filling</th>
<th>Population</th>
<th>Per capita demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 nos</td>
<td>5000 liters</td>
<td>3 times</td>
<td>160 P</td>
<td>135 LPCD</td>
</tr>
</tbody>
</table>

**Contour Plot**

- Fig. 1. Plan of Bearys Institute of Technology (BIT) showing various blocks and water tank with daily loading.
- Fig. 2. Contour plot of proposed study area at Bearys Institute of Technology
CALCULATION

Flow rate  
Quantity of water supplied  
Quantity of wastewater generated  
Assume peak factor  
Total quantity of wastewater generated

RESULT

Quantity of wastewater generated

Consider future expansion and peak demand

IV. DESIGN OF VARIOUS TREATMENT UNITS

Sewage treatment can be categorized as aerobic and anaerobic process. Aerobic is of primary treatment, secondary treatment, biological treatment, miscellaneous and tertiary treatment. Primary treatment consists of equalization tank and flash mixer. Secondary and biological treatment consists of sand filter and sludge drying bed. Miscellaneous consists of disinfection tank. The design of Equalization tank, flash mixer, clarifier, rapid gravity filter, disinfection tank and the sludge drying bed have been calculated based on the quantity of wastewater generated [5]. The layout plan and the cross section of the proposed STP are presented in Fig 3 and Fig 4, respectively. However, the summary of the designed STP units showed in Table 1.

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**Fig. 3. Layout plan of STP unitat Bearys Institute of Technology.**
Table 1. Summary of the dimensions of the various treatment units in STP at BIT campus

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Eq tank</th>
<th>FM</th>
<th>CF</th>
<th>SDB</th>
<th>RGF</th>
<th>Dis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow rate (Q)</td>
<td>m³/d</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Detention time (Dt)</td>
<td>sec</td>
<td>3600</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume (Vol)</td>
<td>m³</td>
<td>5</td>
<td>0.052</td>
<td>Dtc = 7200</td>
<td>14.17</td>
<td>28.06</td>
<td>1.04</td>
</tr>
<tr>
<td>Length (L)</td>
<td>m</td>
<td>2.24</td>
<td>0.30</td>
<td>4.04</td>
<td>6.01</td>
<td>1.02</td>
<td></td>
</tr>
<tr>
<td>Width (B)</td>
<td>m</td>
<td>1.49</td>
<td>0.30</td>
<td>2.70</td>
<td>4.62</td>
<td>0.68</td>
<td></td>
</tr>
<tr>
<td>Depth (H)</td>
<td>m</td>
<td>1.50</td>
<td>0.59</td>
<td>2.63</td>
<td>1.30</td>
<td>1.01</td>
<td>1.5</td>
</tr>
<tr>
<td>Pipe diameter (d)</td>
<td>m</td>
<td>0.15</td>
<td>0.10</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>Additional Info</td>
<td></td>
<td>df = 0.94</td>
<td>dc = 2.27</td>
<td>Vol(s) = 3.27</td>
<td>Rf = 0.075</td>
<td>Cl₂ = 0.25 kg/d</td>
<td></td>
</tr>
</tbody>
</table>

V. RESULTS AND DISCUSSION

COST ESTIMATION OF EQUALIZATION TANK

Given

Length
Breath
Depth
Wall thickness
No of walls
Effective length
Effective breadth
Floor thickness

2.24 m
1.49 m
1.5 m
0.23 m
2 nos
1.78 m
1.03 m
0.15 m
<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Footing projection</td>
<td>0.15 m</td>
</tr>
<tr>
<td>Length of PCC bed</td>
<td>Lp 2.54 m</td>
</tr>
<tr>
<td>Breadth of PCC bed</td>
<td>Bp 1.79 m</td>
</tr>
<tr>
<td>Ground level</td>
<td>Dg 1 m</td>
</tr>
<tr>
<td>Depth of PCC bed</td>
<td>Dp 0.2 m</td>
</tr>
<tr>
<td>Plastering thickness</td>
<td>tp 0.01 m</td>
</tr>
<tr>
<td>As per Code book area of 1 m³ requires</td>
<td>500 Bricks</td>
</tr>
<tr>
<td>Proportion of concrete</td>
<td>1 2 4 c s ca</td>
</tr>
<tr>
<td>As per Standard 50kg of a cement bag</td>
<td>0.0345 m³</td>
</tr>
<tr>
<td>1 bag cement</td>
<td>50 kg</td>
</tr>
<tr>
<td>Pipe dia</td>
<td>0.015 m</td>
</tr>
<tr>
<td>Pipe length</td>
<td>5 m</td>
</tr>
<tr>
<td>Cost of pipe per m</td>
<td>100 Rs</td>
</tr>
<tr>
<td>1 CFT</td>
<td>68.15 kg</td>
</tr>
<tr>
<td>Floor bed:</td>
<td></td>
</tr>
<tr>
<td>Quantity of Floor work</td>
<td>Le<em>Be</em>Ft 0.275 m³</td>
</tr>
<tr>
<td>Brick work:</td>
<td></td>
</tr>
<tr>
<td>Outer area</td>
<td>L<em>No of walls</em>D*t 1.5456 m²</td>
</tr>
<tr>
<td>Inner area</td>
<td>Be<em>No of walls</em>D*t 0.711 m²</td>
</tr>
<tr>
<td>Total quantity of brick work</td>
<td>2.256 m²</td>
</tr>
<tr>
<td>We have, 1 m³</td>
<td>500 bricks</td>
</tr>
<tr>
<td>Therefore, no of bricks</td>
<td>brick work*nos 1128 nos</td>
</tr>
<tr>
<td>Plain cement concrete (PCC):</td>
<td></td>
</tr>
<tr>
<td>Quantity of PCC</td>
<td>Lp<em>Bp</em>Dp 0.90932 m³</td>
</tr>
<tr>
<td>Plastering of wall:</td>
<td></td>
</tr>
<tr>
<td>Length of Inner wall</td>
<td>L<em>No of walls</em>D 6.72 m²</td>
</tr>
<tr>
<td>Breadth of Inner wall</td>
<td>B<em>No of walls</em>D 4.47 m²</td>
</tr>
<tr>
<td>Length of outer wall</td>
<td>Le<em>No of walls</em>D 5.34 m²</td>
</tr>
<tr>
<td>Breadth of outer wall</td>
<td>Be<em>No of walls</em>D 3.09 m²</td>
</tr>
<tr>
<td>Assumed Plastering thickness</td>
<td>tp 0.01 m</td>
</tr>
<tr>
<td>Total quantity of plastering of wall</td>
<td>0.20 m³</td>
</tr>
<tr>
<td>Total quantity of concrete</td>
<td>1.38 m³</td>
</tr>
<tr>
<td>Earthwork excavation</td>
<td></td>
</tr>
<tr>
<td>Quantity of earthwork excavation</td>
<td>L<em>B</em>(Dg+Dp) 4.005 m³</td>
</tr>
<tr>
<td>Quantity of Cement, Sand, Coarse aggregate</td>
<td></td>
</tr>
<tr>
<td>No of bags of Cement</td>
<td>Total quantity/standard 40.01 bags</td>
</tr>
<tr>
<td>Quantity of cement</td>
<td>bags*kg 2000.26 kg</td>
</tr>
<tr>
<td>Quantity of sand</td>
<td>from 1:2:4 4000.51 kg</td>
</tr>
<tr>
<td>Quantity of coarse aggregate</td>
<td></td>
</tr>
<tr>
<td>Vol of floor + PCC</td>
<td>1.184 m³</td>
</tr>
<tr>
<td>Quantity</td>
<td>(vol/0.0345)<em>50kg</em>Proportion 6865.68 kg</td>
</tr>
<tr>
<td>Assumed litres of paint</td>
<td>20 litres</td>
</tr>
<tr>
<td>Abstract table</td>
<td></td>
</tr>
<tr>
<td>Rate of a cement bag</td>
<td>410 rupees</td>
</tr>
<tr>
<td>Rate of a Wire cut brick</td>
<td>9 rupees</td>
</tr>
<tr>
<td>Rate of a Sand load</td>
<td>1.514 rupees/kg</td>
</tr>
<tr>
<td>Rate of Coarse aggregate</td>
<td>1.57 rupees/kg</td>
</tr>
</tbody>
</table>
Rate of Paint 250 rupees/litre

Rate of a Labour
Mason 700 rupees/day
Male helper 500 rupees/day
Female helper 400 rupees/day
No of Mason 2 Nos
No of Male helper 2 Nos
No of Female helper 2 Nos
Working days 4 days

Cost estimation
Cost for cement 16402 rupees
Cost for sand 4001 rupees
Cost of coarse aggregate 10779.1 rupees
Cost of Brick 10151.8 rupees
Cost of Pipe 500 rupees
Cost of painting 5000 rupees
Cost of labours
Mason 5600 rupees
Male helper 4000 rupees
Female helper 3200 rupees
Estimated cost 59633 rupees
Contractors profit 10% 5963.35 rupees
Total Estimated Cost Rs. 65597

COST ESTIMATION OF FLASH MIXER

Given
Length L 0.3 m
Breadth B 0.3 m
Depth D 0.6 m
Wall thickness t 0.1 m
No of walls 2 nos
Effective length Le 0.1 m
Effective breadth Be 0.1 m
Floor thickness Ft 0.15 m
Footing projection 0.15 m
Length of PCC bed Lp 0.6 m
Breadth of PCC bed Bp 0.6 m
Ground level Dg 0 m
Depth of PCC bed Dp 0.2 m
Plastering thickness tp 0.01 m
As per Code book area of 1 m² requires 500 Bricks
Proportion of concrete

<table>
<thead>
<tr>
<th>c</th>
<th>1</th>
<th>2</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>s</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Roof top cover thickness tr 0.15 m³
As per Standard 50kg of a cement bag 0.0345 m³
1 bag cement 50 kg
Pipe dia 0.015 m
Pipe length 5 m
Cost of pipe per m 100 Rs
Assumed litres of paint 10 litres
Floor bed:  
Quantity of Floor work:  \( L_e \times B_e \times F_t \)  
\( 0.002 \ m^3 \)

Brick work:  
Outer area:  \( L \times \text{No of walls} \times D \times t \)  
\( 0.036 \ m^3 \)

Inner area:  \( B_e \times \text{No of walls} \times D \times t \)  
\( 0.012 \ m^3 \)

Total quantity of brick work  
\( 0.048 \ m^3 \)

We have,  \( 1 \ m^3 = 500 \) bricks  
Therefore, no of bricks  
\( \text{brick work} \times \text{nos} = 24 \) nos

Plain cement concrete (PCC):  
Quantity of PCC:  \( L_p \times B_p \times D_p \)  
\( 0.072 \ m^3 \)

Plastering of wall:  
Length of Inner wall:  \( L \times \text{No of walls} \times D \)  
\( 0.36 \ m^2 \)

Breadth of Inner wall:  \( B \times \text{No of walls} \times D \)  
\( 0.36 \ m^2 \)

Length of outer wall:  \( L_e \times \text{No of walls} \times D \)  
\( 0.12 \ m^2 \)

Breadth of outer wall:  \( B_e \times \text{No of walls} \times D \)  
\( 0.12 \ m^2 \)

Total quantity of plastering of wall  
\( 0.092 \ m^3 \)

Roof top slab:  
Quantity of concrete:  \( L \times B \times t_r \)  
\( 0.014 \ m^3 \)

Assumed Plastering thickness  
\( t_p \)  
\( 0.01 \ m \)

Total quantity of concrete  
\( 0.096 \ m^3 \)

Earthwork excavation:  
Quantity of earthwork excavation:  \( L \times B \times (D_g + D_p) \)  
\( 0.018 \ m^3 \)

Quantity of earthwork excavation:  \( L \times B \times (D_g + D_p) \)  
\( 0.018 \ m^3 \)

Quantity of cement, Sand, Coarse aggregate:  
No of bags of Cement  
Total quantity/standard  
\( 2.79 \) bags

Quantity of cement  
\( \text{bags} \times \text{kg} \)  
\( 139.49 \) kg

Quantity of sand  
from 1:2:4  
\( 278.9761 \) kg

Quantity of coarse aggregate  
Vol of floor + PCC  
\( 0.074 \ m^3 \)

Quantity  
\( (\text{vol}/0.0345) \times 500 \) kg  
\( 426.087 \) kg

Abstract table:  
Rate of a cement bag  
\( 410 \) rupees

Rate of a Wire cut brick  
\( 9 \) rupees

Rate of a Sand load  
\( 1.514 \) rupees/kg

Rate of Coarse aggregate  
\( 1.57 \) rupees/kg

Rate of Paint  
\( 250 \) rupees/litre

Rate of a Labour:  
Mason  
\( 700 \) rupees/day

Male helper  
\( 500 \) rupees/day

Female helper  
\( 400 \) rupees/day

No of Mason  
\( 2 \) Nos

No of Male helper  
\( 2 \) Nos

No of Female helper  
\( 2 \) Nos

Working days  
\( 3 \) days

Cost estimation:  
Cost for cement  
\( 1144 \) rupees

Cost for sand  
\( 279 \) rupees

Cost of coarse aggregate  
\( 668.9565 \) rupees

Cost of Brick  
\( 214.4104 \) rupees

Cost of Pipe  
\( 500 \) rupees
Cost of painting 2500 rupees
Cost of labours
Mason 4200 rupees
Male helper 3000 rupees
Female helper 2400 rupees
Estimated cost 14906 rupees
Contractors profit 10% 1490.614 rupees
Total Estimated Cost Rs. 16397

COST ESTIMATION OF CLARIFLOCCULATOR

Given
Outer diameter \(d_1\) 2.27 m
Inner diameter \(d_2\) 0.94 m
Depth \(D\) 2.63 m
Wall thickness \(t\) 0.23 m
Outer Dia with thickness \(d_{1t}\) 2.5 m
Inner Dia with thickness \(d_{2t}\) 1.17 m
Floor thickness \(Ft\) 0.15 m
Footing projection 0.15 m
Outer Dia of PCC bed \(d_{1p}\) 2.42 m
Inner Dia of PCC bed \(d_{2p}\) 1.09 m
Ground level \(D_g\) 1.63 m
Depth of PCC bed \(D_p\) 0.2 m
Plastering thickness \(t_p\) 0.01 m
As per Code book, area of 1 m\(^3\) requires 500 Bricks
Proportion of concrete 1 2 4
c s ca

As per Standard 50kg of a cement bag 0.0345 m\(^3\)
1 bag cement 50 kg
Pipe dia 0.015 m
Pipe length 5 m
Cost of pipe per m 100 Rs
1 CFT 68.15 kg

Floor bed:
Quantity of Floor work
Outer diameter area \(2\times3.14\times\frac{d_1}{2}\) 7.128 m
Inner diameter area \(2\times3.14\times\frac{d_2}{2}\) 2.952 m
Quantity of outer dia floor 4.312 m\(^3\)
Quantity of inner dia floor 1.785 m\(^3\)

Brick work:
Total quantity of brick work 6.093 m\(^3\)
We have, 1 m\(^3\) 500 bricks

No of bricks 3046.65 Nos

Plain cement concrete (PCC):
Quantity of Inner bed PCC \((3.14(d_2)/4)\times Ft\) 0.125 m\(^3\)
Quantity of Outer bed PCC \((3.14(d_1)/4)\times Ft\) 0.052 m\(^3\)

Deduction:
Inner area \((3.14*(((d_1+t)^2))/4\) 1.075 m\(^3\)
Overall deduction
Inner 4.045 m\(^3\)
Outer
Total Quantity
Assumed Plastering thickness
Total quantity of plastering of wall
Total quantity of concrete
Earthwork excavation
Quantity of earthwork excavation
Quantity of cement, Sand, Coarse aggregate
No of bags of Cement
Quantity of sand
Quantity of cement
Quantity of sand
Vol of floor + PCC
Quantity
Assumed litres of paint
Abstract table
Rate of a cement bag
Rate of a Wire cut brick
Rate of a Sand load
Rate of Coarse aggregate
Rate of Paint
Rate of a Labour
Mason
Male helper
Female helper
No of Mason
No of Male helper
No of Female helper
Working days
Cost estimation
Cost for cement
Cost for sand
Cost of coarse aggregate
Cost of Brick
Cost of Pipe
Cost of painting
Cost of labours
Mason
Male helper
Female helper
Estimated cost
Contractors profit
Total Estimated Cost

COST ESTIMATION OF SLUDGE DRYING BED
Given
Length
Breadth

4.04 m
2.7 m
Depth \( D \) \( 1.3 \) m
Wall thickness \( t \) \( 0.23 \) m
No of walls \( \) \( 2 \) nos
Effective length \( Le \) \( 3.58 \) m
Effective breadth \( Be \) \( 2.24 \) m
Floor thickness \( Ft \) \( 0.15 \) m
Footing projection \( 0.15 \) m
Length of PCC bed \( Lp \) \( 4.34 \) m
Breadth of PCC bed \( Bp \) \( 3 \) m
Ground level \( Dg \) \( 0 \) m
Depth of PCC bed \( Dp \) \( 0.2 \) m
Plastering thickness \( tp \) \( 0.01 \) m
As per Code book, area of 1 m\(^3\) requires 500 Bricks

Proportion of concrete
\[
\begin{array}{ccc}
1 & 2 & 4 \\
c & s & ca
\end{array}
\]

As per Standard 50kg of a cement bag 0.0345 m\(^3\)
1 bag cement 50 kg
Pipe dia 0.015 m
Pipe length 15 m
Cost of pipe per m 100 Rs
Floor bed:
Quantity of Floor work \( Le*Be*Ft \) 1.203 m\(^3\)
Brick work:
Outer area \( L*No \ of \ walls*D*t \) 2.41592 m\(^3\)
Inner area \( Be*No \ of \ walls*D*t \) 1.340 m\(^3\)
Total quantity of brick work 3.755 m\(^3\)
We have, 1 m\(^3\) 500 bricks
Therefore, no of bricks brick work*nos 1878 nos

Plain cement concrete (PCC):
Quantity of PCC \( Lp*Bp*Dp \) 2.604 m\(^3\)
Plastering of wall:
Length of Inner wall \( L*No \ of \ walls*D \) 10.504 m\(^2\)
Breadth of Inner wall \( B*No \ of \ walls*D \) 7.02 m\(^2\)
Length of outer wall \( Le*No \ of \ walls*D \) 9.308 m\(^2\)
Breadth of outer wall \( Be*No \ of \ walls*D \) 5.824 m\(^2\)
Assumed Plastering thickness \( tp \) 0.01 m
Total quantity of plastering of wall 0.326 m\(^3\)
Total quantity of concrete 4.133 m\(^3\)

Earthwork excavation
Quantity of earthwork excavation \( L*B*(Dg+Dp) \) 2.182 m\(^3\)

Quantity of Cement, Sand, Coarse aggregate
No of bags of Cement Total quantity/standard 119.80 bags
Quantity of cement bags*kg 5989.98 kg
Quantity of sand from 1:2:4 11980 kg
Quantity of coarse aggregate
Vol of floor + PCC 3.807 m\(^3\)
Quantity (vol/0.0345)*50kg*Proportion 22068.9 kg
Assumed litres of paint 30 litres

Abstract table
Rate of a cement bag 410 rupees
Rate of a Wire cut brick 9 rupees
Rate of a Sand load 1.54 rupees/kg
Rate of Coarse aggregate 1.57 rupees/kg
Rate of Paint 250 rupees/litre

Rate of a Labour
Mason 700 rupees/day
Male helper 500 rupees/day
Female helper 400 rupees/day
No of Mason 2 Nos
No of Male helper 2 Nos
No of Female helper 2 Nos
Working days 5 days

Cost estimation
Cost for cement 49118 rupees
Cost for sand 11980 rupees
Cost of coarse aggregate 34648.1 rupees
Cost of Brick 16897.9 rupees
Cost of Pipe 1500 rupees
Cost of painting 7500 rupees
Cost of labours
Mason 7000 rupees
Male helper 5000 rupees
Female helper 4000 rupees
Estimated cost 137644 rupees
Contractors profit 10% 13764.4 rupees
Estimated Cost Rs. 151408

COST ESTIMATION OF RAPID GRAVITY FILTER
Given
Length L 6.01 m
Breadth B 4.62 m
Depth D 1.01 m
Wall thickness t 0.23 m
No of walls 2
Effective length Le 5.55 m
Effective breadth Be 4.16 m
Floor thickness Ft 0.15 m
Footing projection 0.15 m
Length of PCC bed Lp 6.31 m
Breadth of PCC bed Bp 4.92 m
Ground level Dg 1 m
Depth of PCC bed Dp 0.2 m
Plastering thickness tp 0.01 m
As per Code book, area of 1 m³ requires 500 Bricks
Proportion of concrete 1 2 4
c s ca
As per Standard 50kg of a cement bag 0.0345 m³
1 bag cement: 50 kg
Pipe dia: 0.015 m
Pipe length: 10 m
Cost of pipe per m: 100 Rs
Floor bed:
- Quantity of Floor work: \( L_e \times B_e \times F_t \) = 3.463 m³
- Brick work:
  - Outer area: \( L \times N_\text{walls} \times D \times t \) = 2.79225 m³
  - Inner area: \( B_e \times N_\text{walls} \times D \times t \) = 1.933 m³
- Total quantity of brick work: 4.725 m³
- We have, 1 m³ = 500 bricks
  - Therefore, no of bricks: brick work*nos = 2362 nos
Plain cement concrete (PCC):
- Quantity of PCC: \( L_p \times B_p \times D_p \) = 6.20904 m³
Plastering of wall:
- Length of Inner wall: \( L \times N_\text{walls} \times D \) = 12.1402 m²
- Breadth of Inner wall: \( B \times N_\text{walls} \times D \) = 9.3324 m²
- Length of outer wall: \( L_e \times N_\text{walls} \times D \) = 11.211 m²
- Breadth of outer wall: \( B_e \times N_\text{walls} \times D \) = 8.4032 m²
- Assumed Plastering thickness: \( t_p \) = 0.01 m
- Total quantity of plastering of wall: 0.411 m³
- Total quantity of concrete: 10.083 m³
Earthwork excavation:
- Quantity of earthwork excavation: \( L \times B \times (D_g + D_p) \) = 33.319 m³
- No of bags of Cement: Total quantity/standard = 292.25 bags
- Quantity of cement: \( \text{bags} \times \text{kg} \) = 14612.69 kg
- Quantity of sand: from 1:2:4 = 29225.4 kg
- Quantity of coarse aggregate: Vol of floor + PCC = 9.672 m³
- Quantity: \((\text{vol}/0.0345) \times 50\text{kg} \times \text{Proportion}\) = 56071 kg
- Assumed litres of paint: 20 litres
Abstract table:
- Rate of a cement bag: 410 rupees
- Rate of a Wire cut brick: 9 rupees
- Rate of a Sand load: 1.514 rupees/kg
- Rate of Coarse aggregate: 1.57 rupees/kg
- Rate of Paint: 250 rupees/litre
**Rate of a Labour**
- Mason: 700 rupees/day
- Male helper: 500 rupees/day
- Female helper: 400 rupees/day
- No of Mason: 2 Nos
- No of Male helper: 2 Nos
- No of Female helper: 2 Nos
- Working days: 6 days
**Cost estimation**
- Cost for cement: 119824 rupees
- Cost for sand: 29225 rupees
Cost of coarse aggregate 88031.4 rupees
Cost of Brick 21260.8 rupees
Cost of Pipe 1000 rupees
Cost of painting 5000 rupees
Cost of labours
Mason 8400 rupees
Male helper 6000 rupees
Female helper 4800 rupees
Estimated cost 283542 rupees
Contractors profit 10% 28354.2 rupees
Total Estimated Cost Rs. 311896

COST ESTIMATION OF DISINFECTION TANK
Given
Length L 1.02 m
Breadth B 0.68 m
Depth D 1.5 m
Wall thickness t 0.23 m
No of walls 2 nos
Effective length Le 0.56 m
Effective breadth Be 0.22 m
Floor thickness Ft 0.15 m
Footing projection 0.15 m
Length of PCC bed Lp 1.32 m
Breadth of PCC bed Bp 0.98 m
Ground level Dg 1 m
Depth of PCC bed Dp 0.2 m
Plastering thickness tp 0.01 m
As per Code book, area of 1 m$^3$ requires 500 Bricks
Roof slab thickness tr 0.15 m
Proportion of concrete

<table>
<thead>
<tr>
<th>c</th>
<th>s</th>
<th>ca</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

As per Standard 50kg of a cement bag
1 bag cement 0.0345 m$^3$
Pipe dia 0.015 m
Pipe length 10 m
Cost of pipe per m 100 Rs
Floor bed:
Quantity of Floor work Le*Be*Ft 0.018 m$^3$
Brick work:
Outer area L*No of walls*D*t 0.7038 m$^3$
Inner area Be*No of walls*D*t 0.152 m$^3$
Total quantity of brick work 0.855 m$^3$
We have, 1 m$^3$ 500 bricks
Therefore, no of bricks brick work*nos 428 nos
Plain cement concrete (PCC):
Quantity of PCC Lp*Bp*Dp 0.25872 m$^3$
Plastering of wall:
Length of Inner wall L*No of walls*D 3.06 m$^2$
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Table 2. Summary of cost estimation of various treatment units of STP at BIT

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VI. CONCLUSIONS

Wastewater discharged into the environment may cause harmful effects if not treated properly. For the treatment of wastewater, proper sewage treatment plant has to be designed. However, estimation of the proposed design is very much important to identify the total cost for the proposed unit to avail the fund. The area available for STP unit at Bearys institute of technology campus is having the contour value of 91.5 m to 92.5 m. Area available for the sewage treatment is 399.81 m² with 300 m² expandable. The cost estimation for cement was found to be Rs. 1,19,824 for Rapid gravity filter and Rs. 76,380 for clarifloculator unit. However, cost of sand was calculated Rs. 29,225 for Rapid gravity filter with coarse aggregate Rs. 88,031. Total Cost of construction for Equalization tank was estimated as Rs. 65,597 with Flash mixer of Rs. 16,397, Sludge drying bed Rs. 1,51,408, Rapid gravity filter of Rs. 31,189,6, Disinfection tank of Rs. 32,342 and clarifloculator of Rs. 26,164,1. Total estimated cost of construction of STP was calculated as Rs. 83,9281.

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REFERENCES


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