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Construction Cost Modeling CCM an Ideal Tool for Value Engineering

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Abstract - Value Engineering is a systematic method to improve the value by examining different functions."Value "as defined is the ratio of function to cost. Value can therefore be increased by either improving the functions or reducing the cost by saving. The difference between the function-cost and function-worth indicates the measure of the potential for cost saving through Value Engineering. Construction Cost Modeling (CCM) is a useful tool where the cost are disproportionately high when considering there function, use, necessity. Construction Cost Modeling is an advance sophisticated technique for Value Engineering in construction management, where it can lead to very substantial of large and complex construction whose cost are disproportionately high when considering there function ,use or necessity, are highest as ideal subjects for cost reduction efforts.

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Construction Cost Modeling CCM an Ideal Tool for Value Engineering

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I. INTRODUCTION

Value Engineering (VE) is a systematic method to improve the "value" of goods or products and services by using an examination of function. Value, is the ratio of function to cost. Value can therefore be increased by either improving the function or saving the cost. It is a primary tenet of value engineering that basic functions be preserved and not be reduced as a consequence of pursuing value improvements. Value engineering is sometimes taught within the project management or construction management as a technique in which the value outputs is optimized by crafting a mix of performance (function) and costs. In most cases this practice identifies and removes unnecessary expenditures, thereby increasing the value for their customers.

Value Engineering follows a structured thought process that is based exclusively on "function", i.e. what something "does" not what it is. This is the basis of what value engineering refers to as "function analysis".

Value Engineering uses rational logic (a unique "how" - "why" questioning technique) and the analysis of function to identify relationships that increase value. It is considered a quantitative method similar to the scientific method, which focuses on hypothesis-conclusion approaches to test relationships, and operations

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research, which uses model building to identify predictive relationships.

II. CONSTRUCTION COST MODELING (CCM)

Value engineering is often done by systematically following a multi-stage job plan. Larry Miles' original system was a six-step procedure which he called the "value analysis job plan." Others have varied the job plan to fit their constraints depending upon the application; they may be four, five, six, or more stages. One modern version has eight steps.

As mention earlier, quite a few refinements, sophistications and advance technique has been added to value engineering. One of them Construction is Cost Modeling CCM; it has the diagrammatic representation of the structure and distribution of cost associated with any project, product or system. In value engineering, it is used to provide an over view of the cost the various element in relation to the other, so that those whose cost are disproportionately high when considering their function, use or necessity .A construction cost module is developed, by breaking down the main project first system under study to its major sub –system, which is further exploded or broken into more details at lower levels in the form of a typical organization chart. The budgeted or estimated cost is then assigned to each element. An overall look at the cost is then assigned to each element in relation to others in the cost structure will highlight those whose costs appear to be too high, when considering their functions and importance. The worth or the lowest cost of providing the essential functions is then assessed by the Team and entered against each element. The difference between the function-cost and function-worth indicates the value gap or value index, which is the measure of the potential for cost saving through Value Engineering. By following the further phases of the VE Job Plan, a large number of ideas for providing the function in other ways are generated through brainstorming, which are then short-listed; investigated and final recommendations are developed. Construction cost modeling is an ideal tool for value engineering in construction management where it can lead to very substantial saving in the execution of large and complex construction projects.

In CCM technique following four basic steps are utilized.

a) *Information Gathering*

This asks what the requirements are for the object. Function analysis, an important technique in value engineering, is usually done in this initial stage. It tries to determine what functions or performance characteristics are important. It asks questions like;

- What does the object do?
- What must it do?
- What should it do?
- What could it do?
- What must it not do?

b) *Alternative Generations (Creation)*

In this stage value engineers ask;
What are the various alternative ways of meeting requirements?
What else will perform the desired function?

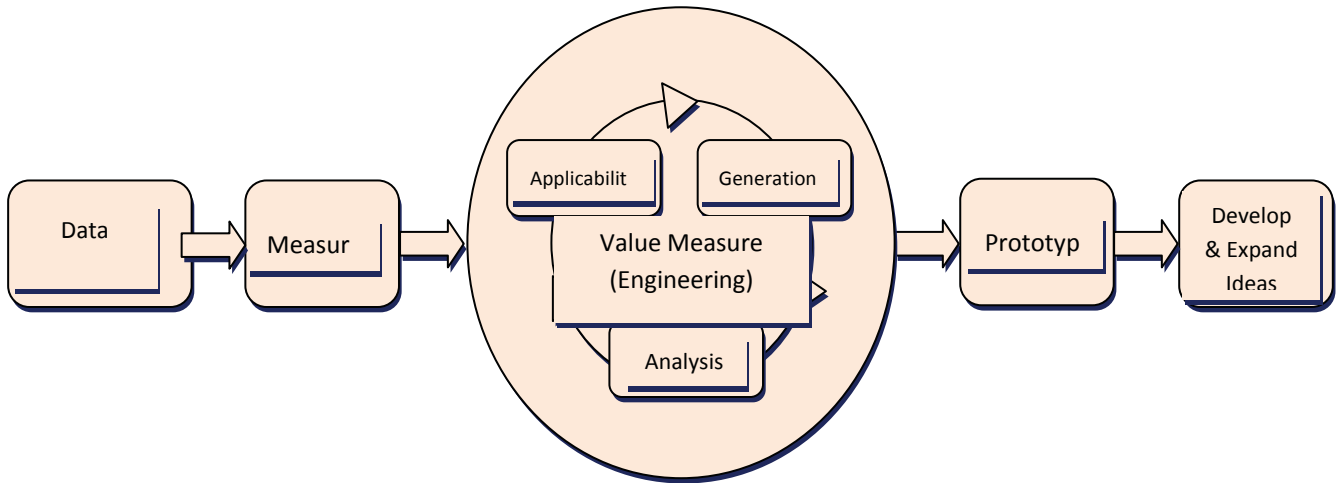
c) *Evaluation*

In this stage all the alternatives are assessed by evaluating.
How well they meet the required functions?
How great will the cost savings be?

III. RECOMMENDATION

In this final stage, the best alternative will be chosen and recommendation to the client for final decision as ideal for cost reduction effort. Develop thing with collaboration of customer.

Figure 1 : Step in CCM for Value Engineering



IV. CASE STUDY: SETTING UP OF A NEW FACTORY

This case study is of a factory located at a distance of 5.5 km from khada village and 1.5 km from Sutrepada village .The access road is khada to Sutrepada a village road of Dhulia Tehsil of district Dhule in Maharashtra State. The factory construction is in survey no. 85 and 88 and the construction of a new loom shade on a land having survey number 105 from the side of lack i.e. Percolation Tank. Figure 2 shows the Layout plan for a recently sited New Factory at Sutrepada at above location. Once the approval was given by the chairman and management of factory, a team of senior executives was assembled under the charge of a General Manager and given the mandate that the project must be completed in time and without asking for additional funds. Unfortunately, there was a steep hike in the price of steel and cement within three months and the new General Manager was hard

pressed to find adequate funds for completing the essential part of the project, by effecting economies elsewhere. Therefore to overcome with this problem CCM technique for value engineering is used. The problem was identify first in the project report and then finding out the maximum scope for cost reduction for achieving savings without loosing out on the basic requirements.

V. METHODOLOGY

Value Engineering was chosen for achieving cost savings and Cost Modelling for identifying the items where savings potential can be maximum. To start, a Construction Cost Model (as shown in Fig.3) was prepared in which all major items of expenditure were shown, under four board headings on one sheet of paper, in order to provide an overview of the costs in relation to one another and to highlight those which were disproportionately high considering their purpose and necessity.

After diagrammatic representation of all the cost and worth cost is calculated and are tabulated in expenditures occurred under the Main Heading, items Table 1.

Table 1 : Expenditure under the Main Heading

Sr. No.	Particulars	Cost in Lakhs	Worth in Lakhs
1	Land	74.31	59.00
2	Leveling and site development	25.00	18.50
3	Factory Office	32.28	12.90
4	Internal Roads	45.44	11.36
5	Compound Wall	39.89	19.94
6	Water and Sewerage Systems	28.00	16.80
7	The Main Factory Buildings		
	1. Sizing/warping/ TFO shade	244.68	224.68
	2. Compression room	41.77	41.77
	3. Boiler house	35.09	35.09
	4. Loom shade	199.54	199.54
	5. Loom plant room	70.80	70.80
	6. Sizing plant room	26.59	26.59
	Subtotal	643.60	623.60
8	Security office,	5.93	0.593
9	Construction of power House	25.13	25.13
10	Canteen and other buildings	19.35	15.48
11	Miscellaneous Civil Engineering Works	25.00	22.5
	Grand Total	938.80	800.67

(Source : Figures of expenditure are collected from site office, as per architect office estimate)

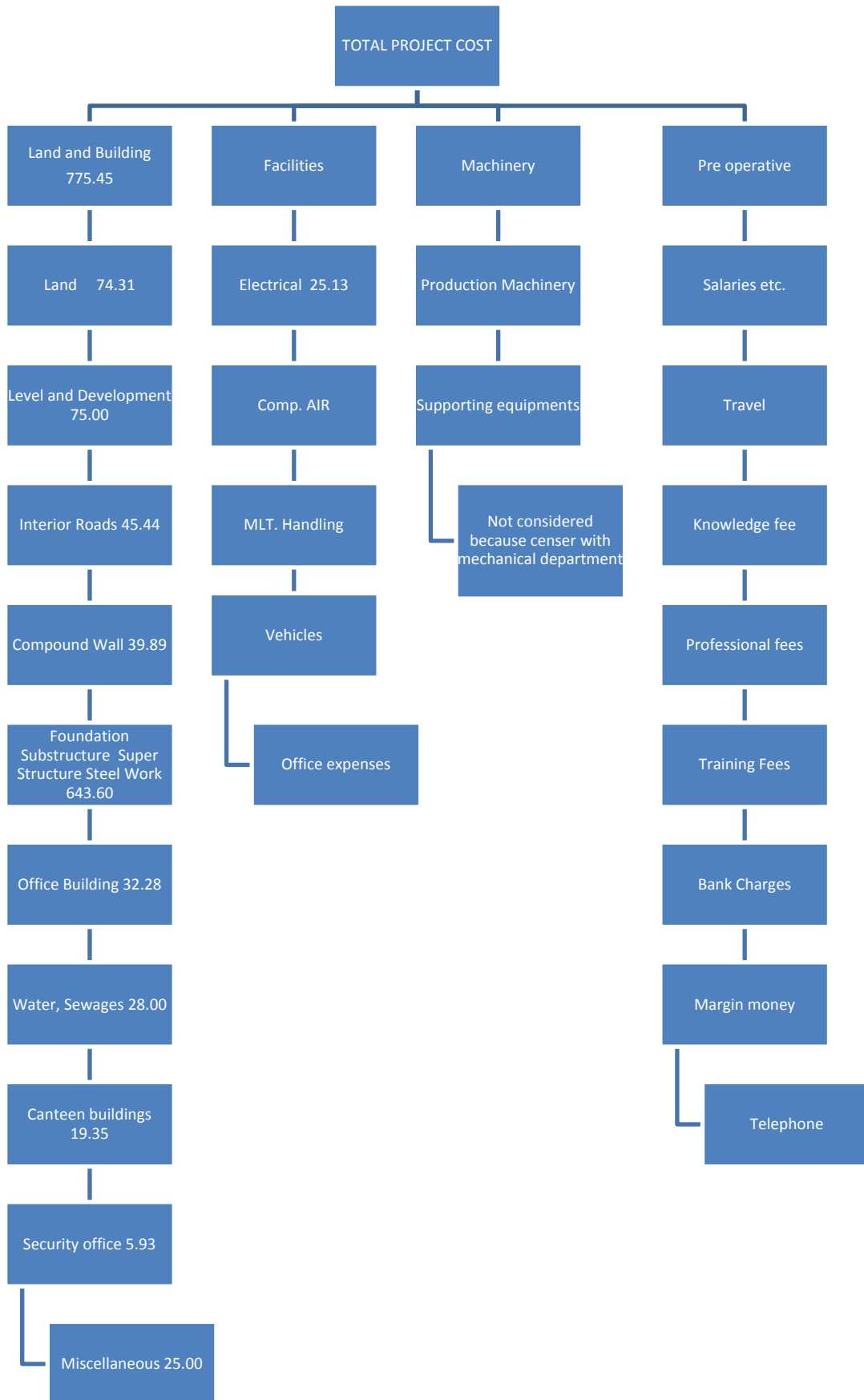


Figure 2 : Construction cost modeling of a new factory building

The project implementation team after collecting the preliminary data whose costs appeared to be too high in relation with the overall project costs and in consideration of their functions and importance prepare a list of such items. Among of those selected items were considered for Value Engineering.

- a) Site development
- b) Factory office
- c) Internal Roads
- d) Compound Wall
- e) Security
- f) Canteen and other buildings.

A team of senior Executives was assembled under the charge of General Manager for CCM, who first identifying their functions, cost and worth. Generating ideas to provide the essential functions in other ways and evaluation of the ideas and short-listing after detailed investigations.

For instance,

- *The function of a Compound Wall was* - to provide privacy, demarcate boundary, prevent trespass, prevent theft, provide aesthetics, and provide security.

A number of ideas were generated in the brainstorming session for providing these functions in other ways and after evaluation and investigation, the team decided to provide a fencing all around, except near the main entrance where the masonry wall was retained as a concession to aesthetics, also the land had been recently acquired in a rural community and the

unlikelihood of theft of the heavy and bulky materials, the team identified “demarcate boundary”, and “prevent trespass” as the basic functions and the others as secondary. The two different planes and cross section for wall compound is shown in figure 4 (a ,b)The actual cost of the construction is 39.89 but the worth is 19.94 , leading to saving of 19.95 on this account alone.

- The Team decided on the conventional location of the Factory office adjoining the main factory building which was preferred by the operating staff and executives. By this, nearly 34.08 cost of the internal roads and leveling and site development, retaining wall which had been planned earlier could also be reduced, resulting in a saving 6.5 overall.
- In the superstructure, a nearly 3 meter high extension of the side walls had been provided by the architects to hide the saw tooth shape of the roofing as a measure of aesthetics. This was promptly dropped by the team which felt that there was nothing wrong in a factory looking like a factory, thereby saving over 20.0
- Similarly, the project team was able to reduce cost in many other areas with the help of Construction Cost Modeling and successfully completing the project within the budget cost, inspite of steep escalations in the cost of steel and cement.

To derive maximum possible benefits from Value Engineering, it should be introduced and practiced as a systematic and continuing activity in the organization for successful launching by Value Engineering programmers.

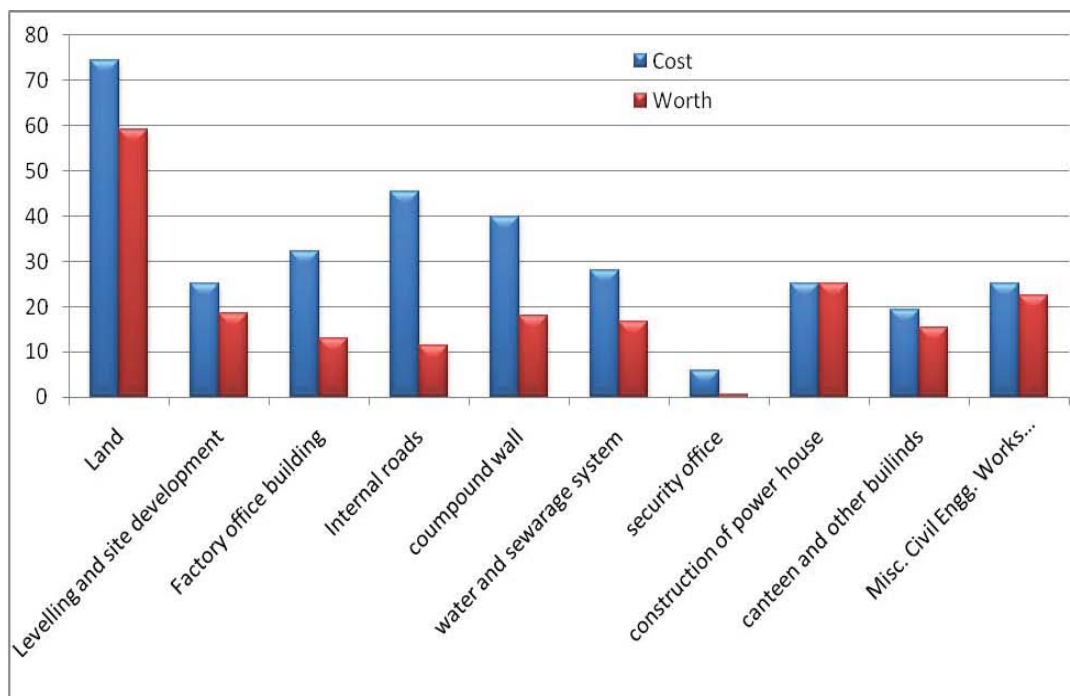


Figure 3 : Graphical representations of Cost and Worth

VI. RESULTS AND DISCUSSION

- Land-Initially the total area of land requirement for the set up of a new factory building is 24.77 Acres, but CCM provide us substantial saving in cost. Minimum 19.67 acres of land is required initially and are purchased which provides sufficient fund saving for other activities .No doughty there is further expansion of factory which requires area of 5.10acres, which can be preached later on stage.
- Leveling and site development - by using CCM it is seen that complete leveling of land is not required for the project, so it is decided to level only the required area of land for project resulting in 25% saving on activity.
- Factory office – for factory office, curtailment of office building is imposed by using CCM technique which reduced the requirement cost by 2 times for office building it suggested a already constructed site office building with addition improvement and alteration.
- Internal Roads –for the transportation purpose and movement of the vehicles internal roads are provided with in the factory premises of cost 45.44 lacks .But to achieve economy and saving in funds for remaining activities, it is decided that only main roads which are 30 % of total road length subjected to heavy loading are constructed with bitumen, and remaining should be of Water Bond Macadamia type.
- Compound Wall –large saving on funds archived by applying CCM technique to compound wall. In this it is suggested to construct a compound wall in two different sections, which are shown at the end of paper. For front side of factory along the road side length section 1 is utilized and for remaining three sides of factory section 2 is suggested, resulting in 50 % saving in original cost.
- Water and Sewerage Systems- It is decided after discussion that only essential part of water supply and sewerage system in initial phase of work which results in 75 % saving on original investment on items.
- Security office- according to CCM technique it is decided to provide security office at the entrance only, using the same infrastruaction of entrance gate
- Canteen and other buildings and Miscellaneous Civil Engineering Works -already low budget buildings have been decided to construct so no major cost saving in this items.

VII. CONCLUSION

CCM technique can be effectively apply to reduced the cost of structure in many of the areas for very large and complex construction whose cost is

disproportionally more than considering these functional use or necessary in spite of steep escalation in the cost of steel, cement and over all cost due hike of market prices. The CCM tech was effective implementation for the construction new factory building at Sutrepada, Dhule (Maharashtra) .At eleven (11) different sections major saving in fund was observed total saving in funds was observed to be 111.75 lacks. This indicates the proportion of CCM as effective technique. However draw back of this technique can not be implemented for the section like power house construction.

VIII. ACKNOWLEDGEMENT

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REFERENCES RÉFÉRENCES REFERENCIAS

1. AbdulMohsenAl-Hammadand Mohmmad A. Hassanain, "Value Engineering in the Assessment of Exterior Building WallSystems", *Journal of Architectural Engineering*, September 1996, pp. 115-119.
2. Assar, S, Jannadi, Oa and Al Tamimi, A, "Computerized System for Application of Value Engineering Methodology", *Journal of Computing in Civil Engineering*, Vol. 14, No. 3, July 2000, pp. 206-214.
3. Larry W. Zimmerman and Glen D Hart, "ValueEngineering", A Practical Approach for Owners, Designers and Contractors, CBS Publishers and Distributors, Delhi.
4. Yang Qing and Qiu Wan Hua, "Value Engineering Analysis and Evaluation for the Second Beijing Capital Airport", *Value World*, Published by SAVE International Beijing (China), Vol. 30, No.1, Spring2007, pp. 1-10.

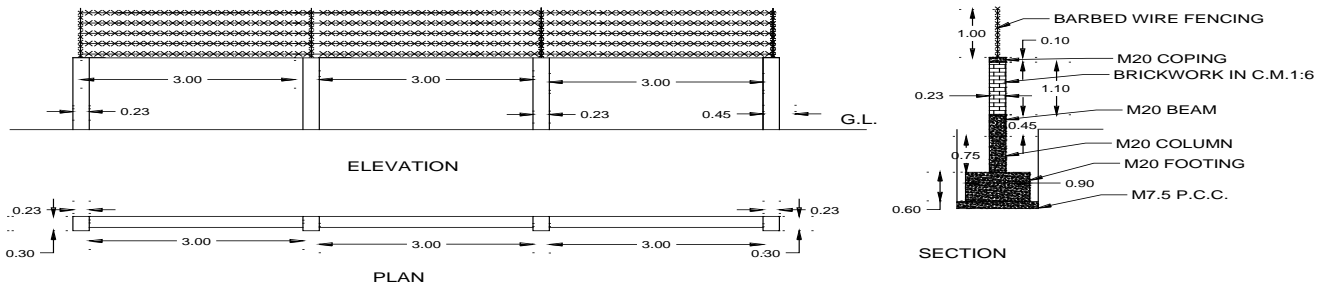


Figure 4a : Plan, elevation and Cross section of wall compound

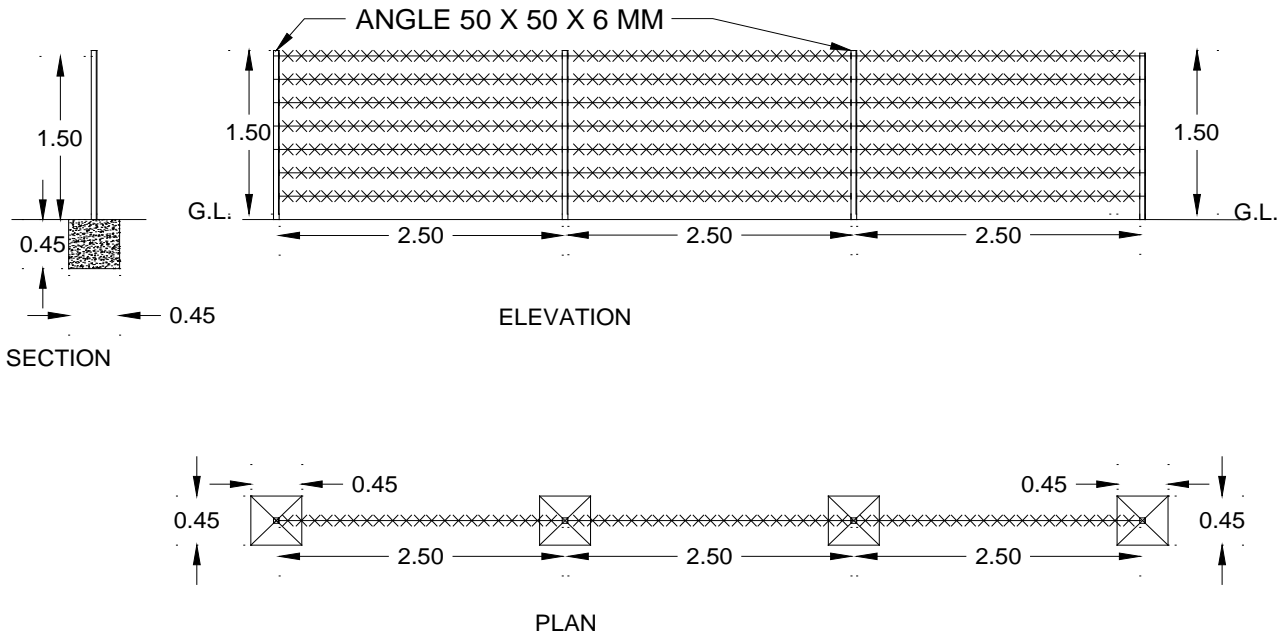
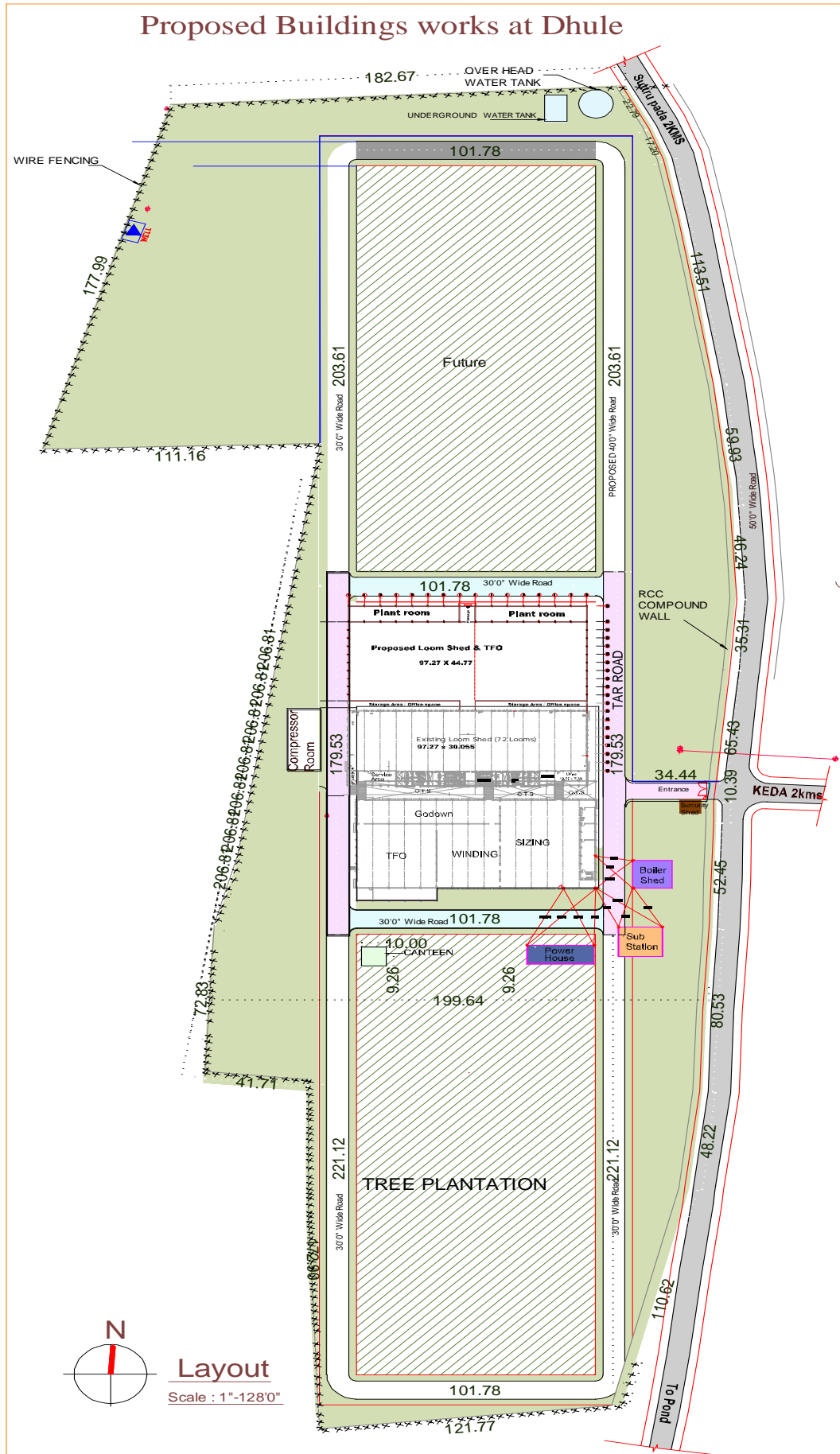


Figure 4b : Plan, elevation and Cross section of wall compound



(Source : Drawing collected from site)
Figure 2 : Layout plan of proposed factory building