

Construction of an Office Building in Sri Lanka

District Election Secretariat, Colombo

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Fig 1: Front view of the Election Secretariat

Abstract

The project described in this paper is a typical construction of a three-storeyed administration building in Sri Lanka. The project is owned by a government department, which does not have its own technical staff. The Buildings Department, whose main function is to assist technically in construction and maintenance of government buildings, was handed over the project by the client. The Buildings Department acted as the consultant, prepared all the drawings and specifications in order to procure the building as per the approved guidelines for tendering and general conditions of contract applicable to contracts in Sri Lanka. During the construction process the consultant faced various problems and hence was forced to complete the project with a belated duration of contract. The author in this paper tries to discuss the reasons behind the delays of completion of the project and consultants obligations generally.

Introduction

Aim of the paper

This paper describes and discusses a building project in Sri Lanka. The project is construction of a 3 storey office building with a floor area of 2133m², for District Election Secretariat in Colombo. Although the project was started in 1995 it is not yet completed and the building is still under construction. This paper aims to describe and analyse the planning and reasons for the delay with some proposals for improvements during construction process of the District Election Secretariat in Colombo.

Back ground and Aim of the Project

After receiving the independence from british colonial rule in 1948, Sri Lanka had the centralised government system to administer the country until the devolution of power to the provincial government by the central government in 1987. Due to this Sri Lanka had to have more elections island wide and on provincial basis, to select representations to the nine provincial councils. Provincial council elections, parliamentary elections and local government elections substantially incresed the work load of the Election Secretariat. Due to this reason the Election Secretariat needed more buildings. A particular building was proposed to fulfil the requirement of Colombo District Election Secretariat to carry out election work pertaining to Colombo District.

The Project



Fig 2: Super structure under progress

As stated earlier, the selected project is the construction of a three storey administrative building for the Election Secretariat in Sri Lanka. The building is an L-shaped one in plan, with 46.1 meters maximum length and 21 meters maximum width. A sketch of the building plan view is given in fig 3.

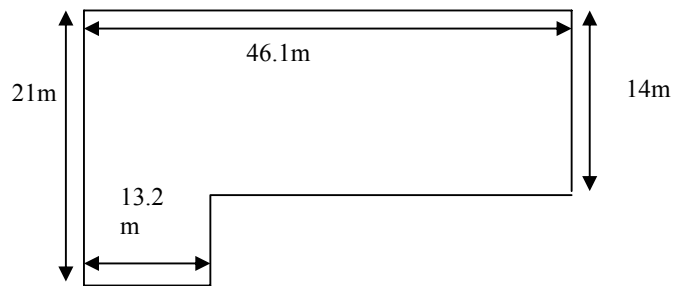


Fig 3: Sketch of the building plan view

The ground floor of the building consists of porch, reception, entrance lobby, two large store areas, paved area for lorry bay, two bath rooms, and two stair cases. First floor of the building consists of the deputy commissioner's room, waiting area, areas for store, records, administration, copying machines, vault, two stair cases and two large bathroom areas.

The plan of the second floor of the building is almost identical to the first floor. The water tank is planned above the lobby area of the third floor with an RCC roof. The scope of the project included the construction of a three storeyed building, with a pile foundation and the following:

- Lighting Arrestor,
- Fire detection system,
- Landscaping ,
- Access roads,
- Storm water disposal systems,
- External water supply and sewerage and a
- Fair face rubble masonry boundary wall .

The Project was planned to be carried out in two stages, sub structure and super structure. The sub structure consisted of 75 piles.

The super structure consists of a 3 storied building with a total floor area of 2133,03m². The total Estimated Cost of the project was Sri Lanka Rupees (Rs) 58.03 Million equivalent to 0.8 Million USD.

Estimated unit cost of the project was Rs 27,570,00 (377.6 US\$) per m²

Selection of contractors for the two stages of the project was by open tender.

Main actors of the project

Client

The client of the project is the Commissioner of Elections. He is the sole authority of the office of the **Election Secretariat**. He is directly responsible to the executive president of Sri Lanka.

Election Secretariat

Election secretariat is the administrative office for carrying out elections in Sri Lanka. Being a democratic government, Sri Lanka has to carry out several elections through out the country in order to choose people's representatives.. Presidential elections are held once in 6 years to elect the executive president of the central government. Parliament Elections are also held once in 6 years to elect representatives to the parliament. As Sri Lanka is now having a decentralised system of administration there are provincial councils for nine provinces of the country. Members of each provincial council are elected by elections held in the respective province. All these elections are carried out by the Election Secretariat situated in Sarana Mawatha, Rajagiriya, which is a suburb of Colombo and within the administrative capital of Sri Lanka. The building project focussed here is the Colombo District Election Office, which is one of the many buildings under the Election Secretariat and meant for the Election works related to Colombo District.

Consultant

The consultant of the project is the Buildings Department under the Ministry of Urban Development Housing and Construction, Sri Lanka.

By the 13th amendment to the constitution of Sri Lanka, promulgated in November 1987, provincial council set-up was established as administrative units at a sub national level. A substantial amount of powers and functions exercise up to that time by the central government has been devolved on the provincial councils. Accordingly central building department is responsible for the work which is coming under the central government.

The Buildings Department is the government department responsible for the construction maintenance and facilitation of the government buildings of Sri Lanka. Buildings Department acts as the client’s representative for many non-technical departments and looks after the interest of the client.

Contractor

There are two contractors for this project. The contractor for the sub structure is State Engineering Co-operation (SEC).

State Engineering Co-operation is a semi government organisation. Which competes in the open market for construction works. At the same time SEC does consultancy works too.

Contractor for the super structure is m/s Sarath Contractors . They are a private contracting firm registered in the Institute of Construction Training & Development (ICTAD) and a member of the National Construction Contractor’s Association Sri Lanka (NCCASL).

Design Stage

Organization Chart of the Buildings Department

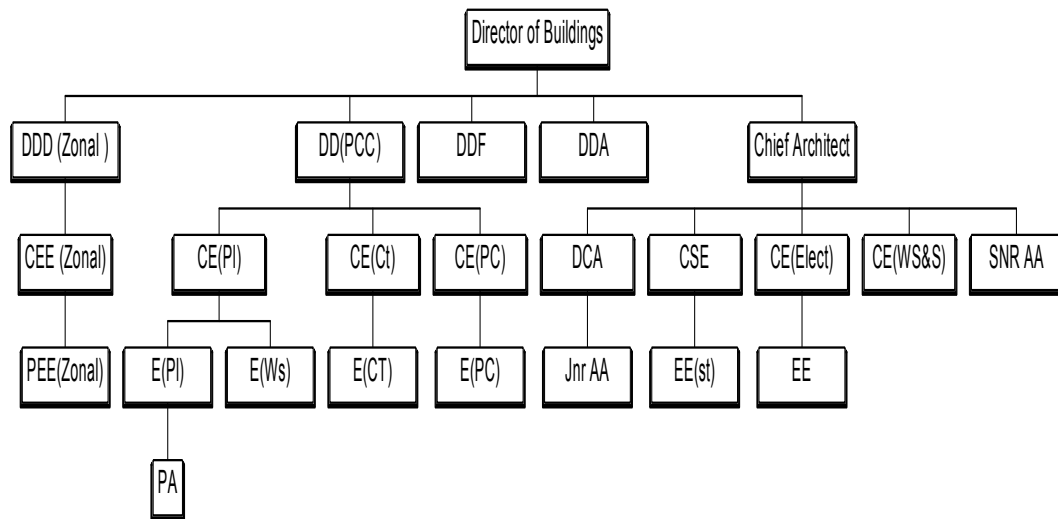


Fig 4

Project Organisation

The Director of Buildings (DB) is the head of the Buildings Department. He is being assisted by six Deputy Directors (DDD) and Additional Director/Chief Architect (CA). DB and DDD are engineers by profession and CA is an architect. The works, which are to be handled by the department, are categorised according to the geographical location of the project and fall in to the purview of DDD DDD are also generally categorised according to the projects handle by them except for the

DD (PCC) who takes care of the Project Control, Contract, Planning, and Quality Control.

Seven Chief Engineers (CEE) attached to zones

There are seven chief engineers attached to zones covering the entire country and according to the concentration of work, for the execution of work

1. CE(Construction) All major construction works in Colombo metro-politan and in the western province
2. CE (Maintenance) All maintenance works in Colombo metro politan and in the western province
3. CE (Southern) All construction and maintenance works in Southern province
4. CE (North) All construction and maintenance works in Northern province
5. CE (North Western) All construction and maintenance works in North Western) province
6. CE (Kandy 1) Construction and maintenance works in Central province
7. CE (Kandy 2) Construction and maintenance works in Central province

Seven Chief Engineers (CEE) attached to Head office

There are seven chief engineers attach to head office to facilitate the flow of work in the head office.

1. CSE In charge of the structural design branch of the head office and responsible for all structural designs; falls under the purview of CA
2. CE (Electrical) In charge of the electrical design branch of the head office and responsible for all electrical designs; falls under the purview of CA
3. CE (Water Supply & Sewerage) In charge of the water supply & sewerage design branch of the head office and responsible for all WS&S designs; falls under the purview of CA
4. CE (Project Control) In charge of the project control branch of the head office and responsible for co-ordination of post contract phase; falls under the purview of DD(PCC)
5. CE (Contract) In charge of the contract branch of the head office and responsible for contract phase; falls under the purview of DD(PCC)
6. CE (Planning) In charge of the planning branch of the head office and responsible for overall and project planning of all the works; falls under the purview of DD(PCC)
7. CE (Estimates) In charge of the estimate branch of the head office and responsible for estimates rates valuation and costing all the works; falls under the purview of CA.

There are engineers attach to each branch and executing offices to handle the quantum of work.

Chief Architect (CA) heads the consultancy division of the head office. CA is assisted by deputy chief architect and three chief Engineers CSE, CE(WS&S), CE(Elect), and other senior and junior engineers and architects.

Project Procurement

The project was initiated by the client by a formal request. The Election Commissioner (the client) made the formal request in 1995, for the design and construction of a building to house the Colombo District Election Secretariat. Action was taken by the Consultancy Division, which is headed by Chief Architect, of the Buildings Department to make the project brief with relevant officials in the client's department in order to carry out the pre feasibility studies. Pre feasibility and feasibility studies were done by the Consultancy Division of the Department.

Buildings Department provides a wide range of services which include pre-feasibility studies, feasibility studies, soil investigations, project management, architectural, structural, water supply, and electrical design, preparation of contract and tender documents, and providing services during construction.

Pre feasibility Studies

A pre feasibility study is done in order to determine the viability of carrying out an expensive detailed feasibility study or whether there is number of possible alternatives.

The activities will generally include the following.

- Study the client's brief and conceptual proposals for the project.
- Collect and review all available data and information relevant or useful to the study.
- Carry out preliminary surveys and investigations where necessary to supplement the available information
- Study alternative proposals where ever possible and recommend the most suitable.
- Make a preliminary environmental impact assessment
- Preliminary estimate of cost on the viability of proceeding to the next stage of the detailed feasibility studies.

Depending on the prefeasibility report the decision is made to carryout the feasibility studies on the project.

Feasibility Studies

The activities will generally includes the followings

- Study and review the project brief, submit comments and make suggestions where necessary for clarifications or improvements of performance in carrying out the project.
- Carry out preliminary surveys and preliminary site and soil investigations and other necessary investigations
- Collect and study all necessary data relevant to the project
- Study statutory and local authority requirements and obtain approval where necessary
- Study possible alternative proposals, which are not studied in the permissibility studies.
- Obtain the advice of other consultants where necessary and co-ordinate with them and any other specialist consultants provided by client.

The consultancy division of the department prepared preliminary drawings. Preliminary Estimate was prepared by the chief engineer construction based on the preliminary drawings. The client department approved preliminary estimate and the drawings. It was decided to carry out the work in two stages, the sub structure and the super structure.

Project Planning

Planning is the pre thinking of What must be done?, When?, How?, and In what order?, Or what sequence?

The project planning will carry out the exercise to:

- Forecast and foresee the activities or operations that have to be performed to achieve the given objective
- Fix realistic duration and time targets for completing the said activities
- Identify the necessary resources for the performance of these activities
- Determine the sequence for performing these activities

The planning process is generally done in the two following levels:

- Macro planning
- Micro planning

A total construction planning process may include:

- Planning and programming of the various construction operations
- Identifying and scheduling the resource requirements
- Preparation of financial plans and cash flow fore cast
- Preparation of systems for progress control, cost control and quality control
- Preparation of material and plant procurement plan
- Preparation of manpower deployment plan or human resource requirement plan

- Preparation of the organisational plan and the plan for the procurement of other services and facilities required for the construction process

In this project the Chief Engineer Planning does the macro level planning at the head office and the executing chief engineer (CEC) at his office does the micro level planning. The project engineer attached to the CEC's office does activity level and site level planning.

Project Financing

Financial planning in any stage of a project is very important in order to assume that there would be adequate funds available to pursue the construction programme, and at the same time not tying up the full cost of the project for the entire construction period. In this project client approved the total cost estimate. Once the client approved the TEC the consultant can go ahead with the project.

Project Financing is the important part done at the head office level by respective DD. Here DDW controls the financing part according to the cash flow forecasting done at the project office.

The money allocated by the client department is usually sent to DB in the form of a cheque. This money is deposited in the DB's private account and the Deputy Director Finance has the control over it. The CECW prepares the cash flow forecasting programmes. The DDW from head office controls the cash flow to the project office, where payments to the contractor are made by CEC.

Cashflow forecasting

It is necessary to take into account the timing and the amount of various payments and receipts. A cash flow is the transfer of money in to or out of the organisation considering the timing and the amount of the transactions. Therefore cash flow forecasting means estimating of the cash position of the project by considering the net effect of cash out flow and inflow and timing of the transactions. Cash flow of the project is forecasted to receive funds from the head office in order to effect contractor's interim bill.

While this project work was progressing, there was a government decision to stop all new constructions programmed for the current year in order to cut down the expenditure. Work was held up due to this until the next year .

There were 15 million Rs available for the year 1995 but not utilised. Work in procurement process started in early 1996.

Budget and Budget Control

The deputy directors prepare the budget for the planned work for the forthcoming year during the first quarter of the current year. Then the director buildings submits the total summed up capital and recurrent expenditure budgets to the ministry of finance, to be included in the nest year's national budget.

Capital expenditure is the expenditure planned for the new construction of buildings, procurements of new machinery or equipment etc. Recurrent Expenditure is the maintenance and all annual expenditure including the salaries of the staff.

Usually the government allocates funds for the capital and maintenance expenditure of buildings to the other departments separately through their own votes. The buildings department gets the funds allocated to it in the formal way after client approves the TEC. The approved TEC becomes the budget for the project. The funds received by the client departments for the capital expenditure is controlled in the head office by respective DDD. The estimate includes the construction of the building, other accessories, the overseerage and contingency component. However the buildings department is not supposed to exceed the TEC.

Information Technology

Information technology plays a wide role in the construction management. Following are some of the ways where information technology or the computers are helpful in the construction industry.

- Updating of schedule of rates to keep up with changing prices of materials.

- Bill of quantities and estimates being done to keep changes to a minimum as the connected drawings are being corrected.
- Technical and other specifications project reports contract documents, are done by moving many paragraphs from various other documents to form new documents
- Repetitive design works to optimise the size or cost being done very fast
- Statistical calculations being done with tedious mathematical analysis instantly
- Fast and timely retrieval of urgent information
- For good presentation reports
- Preparation of cash flow diagrams budgets, instant knowledge of the project's cash situation
- Project planning done using resource scheduling techniques resources histograms

In the design stage of the project macro level planning was done by this writer as CE planning using the micro soft project package.

Conclusions

The famous statement says, "Failing to plan is planning to fail". Accordingly the planning and the design can be considered as the most important phase of the project. It is essential to spent more time on planning of project making, prior correspondence with out side authorities where necessary, in order to arrive on the correct decision before actual design work starts. Also it is essential to pay attention on the design, as alternative methodology of doing the same thing with improved economy or improved quality etc. are possible. Information technology can be used in wide ways to compare previous projects with similar conditions and learn out of them.

Planning and design should be the most attention paid stages in a construction project as the building ones constructed couldn't be changed easily. It will affect the lifetime of the project if anything went wrong.

Production Stage

After the design stage is completed, it is required to construct the building. A contractor has to be selected to carry out the construction works. Also it is essential to construct the building as per plans, bill of quantities, and specifications prepared by the consultants within the specified time period and financial framework.

Tendering and Contract

The quantities for various constructional elements and installations are estimated. The bill of quantities and the firm estimate prepared subsequently. The total Estimated Cost was obtained and the client's approval was already obtained.

Tendering Stage

After getting the estimate approved, the tender document has to be prepared. At first draft tender documents are prepared and it consisted the following:

- Approved Estimate
- Bill of Quantities
- Drawings
- Specifications
- Conditions of tender
- Articles of Agreements
- Paper notice

The following activities have to be carried out at this stage:

- Prepare pre qualification of prospective tenderers and evaluation procedure.
- Pre qualification of contractors
- Invitation of tenders

- Tender evaluation and submit a report recommending the successful tenderer
- Prepare contract document
- Award of contract

The draft tender documents should be prepared and submitted to the relevant tender board, which has the authority to give the approval. The minimum number of members in the tender board is three. As the TEC was exceeding the Departmental Tender board value it was required to go to the Ministry tender board. The chairman of the tender board was the Secretary to the ministry of urban development Housing and Construction. The tender notice was published in newspapers after the approval was obtained for the draft tender documents. Tender forms in duplicates would be issued to the interested tenderers after receiving the non-refundable tender guaranties. Tenderers submit their tenders with the bid bond as per the requirement on or before the scheduled time. The tender board opens the tender box and reads the names and their tendered amounts to the tenderers or their representatives. Then the tenders are handed over to the evaluation committee for the evaluation. The TEC study the tenders carefully and submit their recommendation for the successful tenderer or some times with recommendations for negotiations.

State Engineering Co-operation was selected, as the suitable contractor for the sub structure and M/s Sarath Contractors was the selected for the super structure of the project.

Contract details of the Sub structure

Date of commencement	04-10-96
Contract period	9 months
Date of completion	31-03-98
Defects liability period	12 months
Insurance Cover	Against all risk for the full contract price to cover the contract period plus the defect liability period (12 months from the date of completion)
Third party insurance	Rs 1,550,000.00 and insurance policy against accidents and injuries to workmen also to be submitted.
Contract amount	Rs 14,419,432.50
Security bond	Rs 360,500.00 should be valid till 03-07-98
Mobilisation advance	Rs 2,884,000.00 and a subsequent advance of 1,442,00.00 in two instalment on submission of a bank guarantee after signing the agreement
Condition to the contractor	At least 15% of the labour force posses national trade test certificate. Or to be arranged to trade test with the National Apprentice and Industrial Training Authority
Work Programme	Submit programme in item wise and activity wise within 14 days of the letter of acceptance issue
Labourers	only Sri Lankan both skilled and unskilled
Amount of liquidated damages	1/4000 of the contract price per day
Limit of the liquidated damages	2% of the contract price
Bonus	nil
Bid bond	Rs 310,000.00
% Retention	10% of the work done, limit 5% of the contract price
Time within which payment has to be made	30 days
Advance payment	30% of the contract price
Contractor:	State Engineering Co-operation (SEC)

Contract details of the Super structure

Date of commencement	19-01-99
Contract period	18 months
Date of completion (due)	18-7-2000
Defects liability period	12 months

Insurance Cover	Against all risk for the full contract price to cover the contract period plus the defect liability period (12 months from the date of completion)
Third party insurance	Rs 1,000,000.00 and insurance policy against accidents and injuries to workmen also to be submitted.
Contract amount	Rs 27,850,545.60
Security bond	Rs 696,300.00 should be valid till 18-07-2001
Mobilisation advance,	Rs 5,570,000.00
Condition to the contractor	At least 15% of the labour force posses national trade test certificate. Or to be arranged to trade test with the National apprentice and industrial training authority.
Work Programme	Submit programme in item wise and activity wise within 14 days of the letter of acceptance issue
Labourers	only Sri Lankan both skilled and unskilled
Amount of liquidated damages	1/4000 of the contract price per day
Limit of the liquidated damages	2% of the contract price
Bonus	nil
Bid bond	Rs 00000
% Retention	10% of the work done, limit 5% of the contract price
Time within which payment is to be made after submission of the bill	30 days
Advance payment	20%of the contract price

Contractor: **M/s Sarath Contractors**

Production Planning

Production Planning is done in the contractors project office in order to complete the project within the agreed time and cost limits. Contractor submits his programme of works according to the micro soft project requirement. The contractors project manager does site level planning at this stage. The CEC who is the project manager from the consultant, also does the planning at site level in order to make sure the completion of the project in the cost and time frame work.

Following are the duties of the consultant's project manager (in this case the CEC) who has to do the site level planning accordingly:

- Site handing over to the contractor
- Supervision or inspection of construction works / monitor progress of construction
- Co-ordinate work with client other consultants, superiors in the buildings department, contractor, and any other parties who are interested in this work
- Safety measures to be carried out in this site to avoid any accidents.
- Quality control of the work and testing to be done.
- Monitoring of financial progress, variation orders, extra works etc.
- Maintaining of good weather condition report of the site and any potential causes for extension applications
- Measurement of work done (mostly done by jointly to avoid any conflicts).
- Checking certifying and making contractor's payments for the work done
- Action to be taken in case of disagreements
- Receipts of materials samples
- Certification of construction materials as per the specifications
- Contract Administration
- Drawings and any clarifications done at the site
- Defects survey upon practical completion of the project and notification to the contractor
- Final inspection upon practical completion of the project
- Certification of the final payment.

Quality Management

The quality can be defined as the ability to meet all the expectations of the purchasers of goods and services. For an example, an office building should satisfy the needs of the staff occupying it and also the customers. In the construction of the structure the needs can be expressed by the following terms.

- Usability
- Safety
- Availability
- Reliability
- Maintainability
- Economics and environment

Quality management is the system of approach aiming at obtaining a product of acceptable quality at the first time.

Given below are ten steps to be followed by the contractor to obtain a quality product

1. Understand and accept contract specifications
2. Obtain all necessary factory test documents of material prior to purchase
3. Obtain time and mode of material transport and necessary warranties
4. Inspect material delivered at site, and accept only the quality checked material for storage
5. Ensure quality transport to and storage and handling at site
6. Exercise all necessary field tests, whether of preparatory conditions materials and equipment prior to installation
7. Ensure all required laboratory test results are available and accepted prior to use
8. Check that the final product is in accordance with the specifications
9. Maintain quality control on site and with back up contact with manufactures and labs during specified maintenance period
10. Make final project inspection with client and consultant. Ensure client understands necessary future maintenance requirements

The consultant's project manager or the CEC did quality management of the project by :

- having regular progress review meetings
- doing testing in appropriate frequency of time and appropriate samples
- proper planning ahead to make sure no materials shortages occur, which force the contractor to use alternative ways.
- monitoring the contractor in material procurement and resource scheduling

Economic Control - Budget review and reconciliation

Economic controls should be practiced at various levels to protect any possible cost overrun of the project. The approved estimate gives the details and quantities of works to be carried out under this project and it becomes the budget for the consultancy organization. The TEC is the upper limit of expenditure that can be reached by the consultant at any stage.

While progressing with the expenditure the DDW reports to the client department monthly of the expenditure statement of the previous month. Also, there are progress review meetings between the client's representative and DB, DDW and this writer as the CE Planning in the head office to review progress of the work. During these meetings the financial position of the work is discussed. Progress review meetings with the contractor, CEC and client's representative are held at the site office weekly. The upper limit for the payments to the contractor is the contract sum. DB cannot approve any variation exceeding 10% of the contract sum. The approval of such payments is done after a tedious way where the secretary to the ministry has to be intervened. Any extra work or variation on the request of the client exceeding 10% of the contract sum is done in this way. CEC takes care of the payments to the contractor after taking and certifying the joint measurements and the work done so far. Cash flow programme and actual cash flow of the work is compared by CEC and he ensures that the financial progress do not exceed the budget. Any variations if occurred, are discussed and reconciled at the project office progress meetings or head office progress meetings.

Conclusions

The production of total project was carried out by two contracts. The sub structure was done by the State Engineering Corporation (SEC) which is a semi-government organisation. Although the project planning was to be completed within 9 months it took more than that. The planning was done by the consultant's office to complete the project in time, but the progress was slow.

Although the project proposal was arrived in 1995 there was a government decision to stop all new projects which were coming in the current year. Due to that the pre construction process was slowed. No production could start until 1996. Pre contract process took until October 1996 to award the contract. This was an unavoidable delay, which could not have been overseen by the executives.

The delays occurred in the piling contract can be attributed to the following:

- Adverse security situation in the country.
- Lack of proper project management in the contractors organisation
- The client is a government organisation and the follow up by the client is not adequate.
- Improper human resource management and time management.
- Numerous government red tapes
- As the contractor and consultant are all government institutions and under the same ministry there were not enough control in order to improve the efficiency of the work.

The consultants requested the grade 25 concrete for the piles, at the same times the cement content should be 390 kgs per m³. The cement content for a grade 25 concrete is 330kgs/m³. The consultant later agreed to the contractor's proposal of bringing up the cement content to 360kg/m³ without considering the grade of the concrete. The exchange of letters between two government offices to resolve a problem took a long time.

The contract of sub structure was delayed due to many reasons and due to that start of super structure was delayed. Contract management was done for the super structure by the CEC. The physical and the financial progress are very much better in this contract. The project is under progress. Progress charts indicate that the progress is good and it will follow the expected path of construction programme.

Numerous decisions must be made during management of a project, which requires a significant amount of time and effort of the project manager. Decision-making involves choosing a course of action from various alternatives. It is the duty of the project manager to know and clearly communicate the project objectives to participants so that their efforts can be focused on the alternatives that apply to the same end result.

Decisions must be made in a timely manner to prevent delays in work. Most of the project decisions are made internally (within the project manager's organisation) which can be managed relatively easily. However some decisions are made externally, outside the project manager's organisation by owners or consultants. Early in the project the project manager must identify those activities that require external decisions so that appropriate information will be provided and the person who will be making decisions can be identified. This must be included in the project schedule to alert the responsible parties so that the project will not be disrupted and delayed due to lack of decision at the proper time.

Time is irreplaceable and vital to every one. A project manager spends a large amount of time with communicating and interchanging with others who are involved with the project. Therefore it is important that the time is spent in a productive and effective manner.

Common time wasters of a project manager are unproductive telephone calls and meetings. Although the telephone is necessary to perform work, it can be quite disruptive in some other way.

Proposals for improvements

More follow-ups by the client is necessary to improve the efficiency of the contractor as well as the consultant as client is the ultimate loser if time or cost over run occurred. Information technology within the consultant's organisation should be

improved so that the history can make lessons for the future. The selection of contract period was made in an arbitrary manner without having considered previous data. The information technology could have played a better role in deciding contract period of contracts by making use of similar history.

The employees of the organisation should be trained in the field of project management

Property Management

The project as a whole, is not yet completed. After the project is complete, the property (building) will be handed over to the client. The contractor will be responsible for the maintenance of the property during the maintenance period, which is 12 months. Thereafter, the client, who is the owner of the property, will have to do the property management. The consultant is not responsible for the property management in this project.

Life cycle economy

It is the responsibility of the consultant to advise the client of not only the construction cost but also over all cost of the project during it's life period, by giving cost benefit analysis of each available option. Even though currently too much care is placed on the initial cost of the project compared with the over all life and the replacement cost, the importance of the life cycle costing is now felt by the professionals in the construction industry.

Maintenance planning

The client will undertake the maintenance planning of the completed building. Usually when a client does not have a technically competent staff for the maintenance of the buildings, the maintenance of all the buildings of the client will be entrusted to the Buildings Department. The government allocates funds for the maintenance of buildings to the respective department. Buildings department draws up plans for the maintenance of the buildings.

Maintenance is done in two ways as below:

- Nominal maintenance
- Periodical maintenance

Nominal maintenance

Respective chief engineers calculate the cost of nominal maintenance of buildings on square foot basis with a flat rate, annually. The annual maintenance cost is intimated to the client organisation. Once the funds for the maintenance are received, the buildings department is responsible to carry out all minor maintenance works with respect to the building promptly.

Periodical Maintenance

Periodical Maintenance is done by the buildings department on a request made by the client, estimate prepared, cost intimated, and on receipt on funds.

Connections to the design stage-feed back

There is no set procedure adopted at present to get any feed back to the designs stage from property management. But as the department does maintenance, there is an indirect feed back, automatically transferring to the design stage.

Conclusions

It is very important to consider the life cycle economy and maintenance management at the design stage of any property. Although the department is doing only as a consultant it is appropriate to adopt a system of advising clients on the property management. It is very much important to design a system of proper feed back to the design stage from maintenance stages. A proper feed back system can alleviate errors and economise the designs.

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