

Proposed Administration Block for Horana Hospital

Wickramage Don Chitrangani

Divisional Engineer (Horana)
Engineering Organisation Of The Western Provincial Council

Summary

A brief description of my country, Sri Lanka together with its administration background is presented briefly in this paper. The different stages of procedures to be carried out from the beginning to the completion of the project and the activities to be carried out during the maintenance period are explained here. The project illustrated in this paper is "The Proposed Administration Block for Horana Hospital" and it is under construction. The problems encountered upto now by the contractor, the consultant as well as the client are also discussed with reasons. Further, it is mentioned about the experiences obtained from this course and how they can be used in future projects.

Aim Of The Paper

The aim of the paper is to propose suggestions to eradicate the shortcomings available at present in the construction management of the Engineering Organisation of the Western Provincial Council.

Introduction

The objective of this presentation is to provide general knowledge about the procedures that are carried out by the Engineering Organisation of the Western Provincial Council in carrying out a construction project from its beginning upto its completion and handing over to the client. Further, it is explained how these procedures were used in the project of "Proposed Administration Block for Horana Hospital". Mainly, there are three stages known as the design stage, the construction stage and the maintenance stage of any building project. Various activities are carried out during these stages and different types of documentations are handled during different phases of projects

The project of "Proposed Administration Block for Horana Hospital" is now under construction and the concrete work of the first floor is in progress. While doing work upto this level, lot of problems were encountered and they are also mentioned here. The experience obtained from this International Construction Management course, to use in future projects are presented in this paper.

Also, it is necessary to provide the reader a brief description of my country to get a general knowledge about its topography, rainfall, temperature, climate, population, administrative background, etc.



Description of Sri Lanka

Sri Lanka has faced many problems in developing an area of rapid urbanisation that occurred due to uncontrolled and haphazard development activities in urban areas for over many years. The squatter settlements in the important parts of the cities where the space needed for planned development activities has to be included in the process of redevelopment. This has posed the problem since resettlement of the same families would require a great effort. The provision of better housing for them, which is the same problem faced by the authorities has not been successful for many reasons. Many squatter families in an urban area are not willing to move to some distant places where they could be accommodated with better facilities,

because their livelihood is based on the economic activities of the particular area. It would not be appropriate to provide them with housing in the particular area that has a potential for the development for activities other than housing.

Therefore the problem of resettling them with their consensus poses the greater challenge for the authorities who should be advocating or promoting the redevelopment of the capital city.

Topography

Sri Lanka is located between 05° 55" and 9° 59" N on Longitude. Sri Lanka was known as Ceylon upto 1972. It is an agricultural island in the Indian ocean. Sri Lanka is famed for her wide tourist attractions within an area of little more than 65,000 sq.km. In general, surface configuration of Sri Lanka comprises a high land massif situated in the South Center, which is surrounded by an intermediate zone of upland ridges and valleys. On the basis of height and land forms, Sri Lanka will be divided roughly into five topographical regions.

1. Central high lands
2. South west country
3. East and South- East country
4. Northern low lands
5. Coastal fringes

The island is 435 km. long and 220 km. wide at its widest point.

Rainfall

As a result of tropical climatic conditions, Sri Lanka in general experiences moderate rainfall at regular intervals throughout the year. Sri Lanka is influenced by the two Monsoons which dominate weather patterns in the Bay of Bengal and the Indian ocean. The South-West monsoon affects the island most strongly from May to August and North-East monsoon from November to February. The South-West of Sri Lanka and most of the central hills, which receive considerable amount of rainfall during both monsoons, are said to comprise the Wet Zone of the island. The flatter lands in the North and East where rainfall is concentrated in the North-East monsoon comprise the Dry Zone. The average rainfall per year is 1875mm in the Northern area, 2050mm. in the central hills and 2232mm. on the West coast.

Temperature

The lowest temperature 11.6°C is found at Nuwara Eliya in the central hills and the highest temperature 31.3°C is found at Jaffna in the Northern area of the island. The temperature (min/max) varies from 24.9°C to 31.3°C at Jaffna. and from 11.6°C to 19.9°C at Nuwara Eliya.

Disaster

Being a tropical country, Sri Lanka experiences some adverse effects of the nature such as Cyclones, Floods,

Lightning, etc. but is completely free from other catastrophic events such as Earth quakes, Volcanic eruptions etc.

People and Population

The present population of 18 million is fairly widespread with a density of 279 per sq. km. and with some concentrations shown in the business capital of Colombo city (1,000,000 inhabitants). In the Administrative Capital Sri Jayawardana Kotte city (200,000) and in Provincial Capitals of Galle, Jaffna, Kandy etc. where each has about 120,000 inhabitants. The country is divided into nine Provinces; Western, Sabaragamuwa, Central, Southern, Northern, North Central, North Western, Eastern and Uva. The population census found 22% of the total population live in Urban areas and 78% in rural areas. The average growth rate is estimated to be 1.7% per annum with the urban areas growing slightly less than rural areas. Out of the total population of 18 million people in Sri Lanka, Sinhala community constitutes 73%, Tamil community 19%, Muslim community 7% and the remaining 1% are Malays, Dutch, Burghers, Eurasians and sole survivors of the pre Sinhala aboroginies, a few jungle Veddas.

The Sinhalese are an Aryan people who migrated in small groups from Northern India to the island 2500 years ago. Colonisation was rapid and the indigenous population was mainly absorbed by the new comers, though some fled into the eastern jungles, where their decedents, the Veddas remain today.

The Tamil community mainly consists of two fractions. The Tamil people who live mainly in the Northern part of the country are the early migrants from Southern part of India, after colonisation began in the north-central province of the country. The other fraction lives mainly in the central hill country and were brought to the island from Southern India by the British colonial rulers in late 19th century to work in their tea plantation in the hill region.

Administrative Background

By the 13th. Ammendment to the Constitution of Sri Lanka promulgated in November 1987, Provincial Council set-up was established as administrative units at a sub national level. Accordingly, it has a Council having legislative powers consisting of members elected by the people of the province and a Board of Ministers vested with executive powers consisting of five Provincial Ministers including the Chief Minister. The implementation of powers conferred on the Provincial Council by the Costitution is supervised by the Govenor appointed by Her Excellency, the President of Sri Lanka. A substantial amount of powers and functions exercised upto that time by the Government have been devolved on the Provincial Councils in terms of the 13th. Amendment to the Constitution. According to the present distribution of subjects and functions those assigned to each Provincial Ministry are as follows.

1. Chief Minister, Law and Order, Finance and Planning, Education, Employment, Construction, Provincial Administration, Local Government, Rural Institutes and Rural Development.

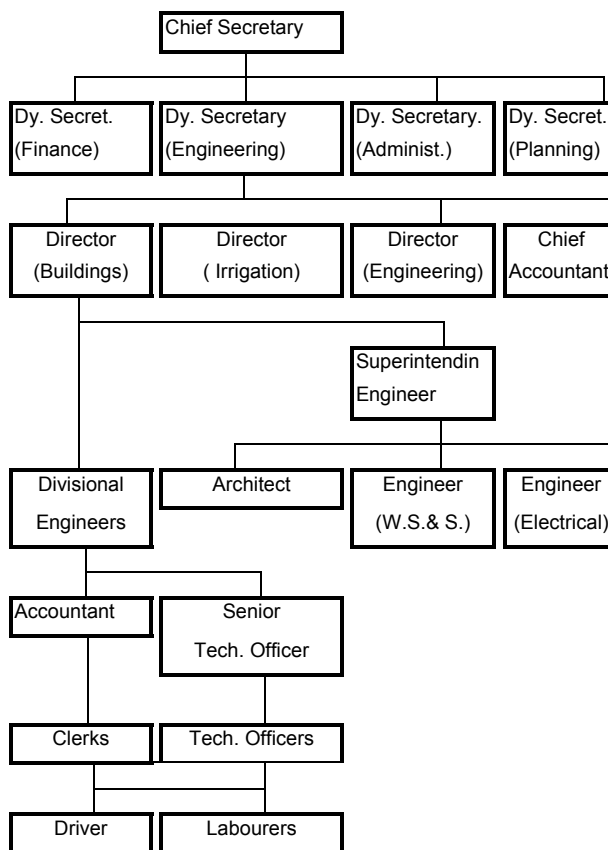
2. Transport, Highways, Housing, Electricity, Town Planning, Sports and Youth Affairs.
3. Agriculture, Lands, Minor Irrigation Works, Animal Production and Health.
4. Health, Co-operatives and Women's Affairs.
5. Small Industries, Textile Industries, Social Services, Probation and Child Care Services, Fisheries, Tourism, Cultural and Arts.

Each Provincial Ministry has several Departments under it, to which subjects and functions have been assigned. The coordination of Divisional Administration and the development work at Divisional Level are handled by the Divisional Secretaries. I am working for the Engineering Organisation of the Western Provincial Council and the Engineering Organisation is directly under the Chief Minister.

Engineering Organisation of the Western Provincial Council

In 1994, the Provincial Engineering Organisation was established for the purpose of construction, planning, designing and execution of projects and for regularising supervision of Engineering Works carried out by the Western Province. Accordingly, the execution and supervision of all projects of the Provincial Council except those that have been entrusted to, at present to the Local Government Institutions and those carried out by the Provincial Road Development Authority, have been entrusted to the Engineering Organisation. The construction and supervision of large scale projects carried out by the Local Government Institutions and scrutiny of estimates of Projects over Rupees 1,000,000 are carried out by the Provincial Road Development Authority are also being handled by the Engineering Organisation. Thirteen Divisional Engineer's offices have been established to cover the works at Western Province. I am one of these 13 Divisional Engineers and I am the Divisional Engineer (Horana).

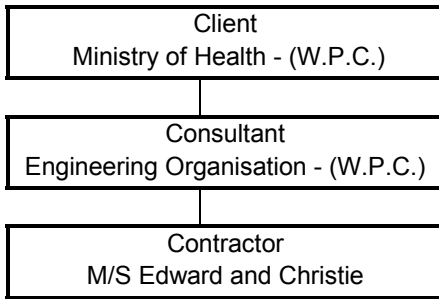
Organisation Chart For The Engineering Organisation Of The Western Provincial Council



Client, Consultant, Contractor and Project Details

The Client of the Project of “Proposed Administration Block for Horana Hospital “ is the Provincial Ministry of Health, Co-operatives and Women Affairs which is a Governmental Institution under the Western Province. The Consultant for the project is the Engineering Organisation of the Western Provincial Council. The Contractor is a private company which was selected by the tender procedure. The contractor is M/S Edward and Christie. The proposed building is a two storeyed building with and area of 22192 sq. ft. The estimated cost is Rupees 36,000,000. This is approximately about SEK4,500,000.

Relationship among the client, consultant and contractor is as follows.



The contract sum for the Proposed Administration Block for Horana Hospital is Rs. 31,965,000.

Design Stage

Consulting Engineers provide a wide range of services which include Pre-Feasibility Studies, Feasibility Studies, Investigations, Project Management, Environmental Impact Assessment, Design, Preparation of Tender and Contract Documents, Services during Construction, Reporting Existing Works etc.

The services provided by a Consulting Engineer will vary in scope and nature and depending on the project and the requirements of the Client. The range of services may cover from pre-feasibility studies for a project upto its completion and maintenance. The Consulting Engineer may work in association with other Consultants, Specialist Consultants, Consultants nominated by the Client and the Client’s own personnel.

Pre-Feasibility Studies

A pre feasibility study is resorted to in order to determine the viability of carrying out an expensive detailed feasibility study or whether there are number of possible alternatives. The activities will generally include the following.

1. Study of the Client’s brief and conceptual proposals for the project.
2. Collect and review all available data and information relevant / useful to the study.
3. Carry out preliminary surveys and investigations appropriate in extent and detail where necessary to supplement available information.
4. Study alternative proposals where alternative proposals are possible and recommend the most suitable.
5. Make a preliminary environmental impact assessment.
6. Prepare a preliminary estimate of cost.
7. Report on the viability of proceeding to the next stage of detailed feasibility studies.

Feasibility Studies

The activities will generally include the following.

1. Study and review the project brief, discuss with the client, and submit comments and make suggestions where necessary for clarification or for improvement of performance in carrying out the project.
2. Carry out preliminary surveys and preliminary site and soil investigations and other necessary investigations appropriate for the study.
3. Collect and study all necessary data relevant to the project.
4. Study statutory and local authority requirements and obtain approval where necessary.
5. Study alternative proposals where these are possible and where a pre-feasibility study of the project has not been carried out.
6. Obtain the advice of other consultants where necessary and coordinate their services and the services of any Specialist Consultants provided by the Client.
7. Prepare preliminary designs and drawings for the proposals including those for the alternative proposals if any.
8. Prepare draft specification.
9. Prepare cost estimates including those for alternative proposals if any.
10. Prepare environmental assessments or reports arising from Statutory planning requirements.
11. Compare alternative proposals where these have been considered, and make recommendations to the client.

In the project of “Proposed Administration Block for Horana Hospital” the Client arranged a discussion with the Consultants. There the Client’s requirements were discussed in detail. The Secretary of the Ministry of Health of the Western Province, the Provincial Director of Health, the Regional Director of Health and the District Medical Officer attended the meeting on behalf of the Client. The Deputy Secretary (Engineering) of the Western Provincial Council, the Director, the Structural Engineer, the Architect and myself being the Divisional Engineer (Horana) attended to the discussion on behalf of the Consultant. Later on a joint site inspection was arranged to the site. As the proposed building is the Administration Block for the hospital, this building should be located in the front side of the hospital premises with an easy access from the main road. Although there is sufficient land for the hospital, the land available in front of the hospital premises is very limited. More than that, what ever the available land in the front of the hospital was an abandoned paddy field. Therefore it was revealed that the extent of land that can be used for this project was restricted. Further, the feasibility study revealed the soil condition was not satisfactory.

The Architect happened to draw the plan for the administration block according to the land available. There

are two roads on two sides of this land and this creates another restriction. This project is to be carried out within the urban limits of the Horana Urban Council. Therefore, it is required to abide by the rules or laws of the Local Authority when planning this building. By considering the Client's requirements including financial limits and the available restricted land and as there were no any other alternatives, sketch plans prepared for the building got an odd shape, but giving the maximum usage of the land available.

In the Design Phase the following should be carried out.

1. Establish design criteria.
2. Site investigations and surveys.
3. Agree time duration and financial condition.
4. Prepare report including fully developed brief programme and outline specification.
5. Preliminary design, draft specification and cost estimates.
6. Review Client's decisions arising from sketch design phase.
7. Alternative proposals.
8. Obtain approval from Local Authorities and any others.

By considering the requirements as well as the restrictions, the sketch plans were drawn. The ground floor of the building consists of specially clinics for Specialist's doctors, Physiotherapy, Emergency Treatment Unit, X-Ray rooms, Scanning, Chemical Section etc. in addition to other general sections such as dispensaries, waiting areas, stores, record rooms, coroner's room, police post, dressing rooms, toilets etc. The upper floor consists of duty rooms, rest rooms, dental clinics, health education section, library, conference room etc. in addition to the general sections such as toilets, rest rooms, record rooms, office etc.

The sketch plan was prepared and was submitted to the Client for approval. The sketch plan was altered several times to satisfy the Client's requirements and subsequently approval was granted.

The Structural Engineer investigated the site conditions and the constraints. Soil investigations were carried out by having trial pits at several places. The ground water table was found 1' 0" below the existing ground level. The soil condition was studied by the observations revealed by trial pits. Accordingly, Structural drawings were prepared. The Electrical Engineer and the Water Supply and Sewerage Engineer prepared the drawings for services. The Architect, the Structural Engineer and the service Engineers met regularly and co-ordinated their work in the Design Stage.

As this building includes two X-Ray rooms approval for this plan should be obtained from the Atomic Energy Authority before construction. The thickness of the walls, the location of openings, quality of covering material for doors and windows etc. are looked into before giving approval. The written approval of the Atomic Energy Authority is very important.

The current practice of construction industry contributes to many of the processes of deteriorating the natural environment. Specially there is a shortage of good

quality timber in Sri Lanka. The government has imposed laws to prevent cutting down certain species of timber. Usage of timber for construction industry for a long period during the past few decades has caused deforestation and this has already influenced the rainfall pattern of Sri Lanka. By considering this fact it was decided to use Aluminium door / window frames and sashes instead of timber door / window frames and sashes. Steel trusses are used for the roof instead of timber frame work. In this way action was taken to select type of materials for the building and to reduce the environmental damage which can be caused by using timber.

Project Financing

Financial Planning in any stage of a project is very important in order to assure that there would be adequate funds available to pursue the construction work. The "Proposed Administration Block For Horana Hospital" is funded by the Ministry of Health in the Western Provincial Council.

Experience to use in future projects

The design stage of a project is very important because if a proper design is not carried out there will be problems during the construction period and during the life time of the building. Therefore, attention should be paid to the following items.

1. Collect all information and data relevant to the project. This can be achieved by discussing with the client, referring to relevant documents, experience obtained from past projects, discussing matters with more experienced persons etc.
2. Proper site investigations should be carried out. If proper site investigations are not carried out, actual problems will be revealed only at the construction stage and this will delay the works of the project. Further, there will be lot of extra works and this will involve extra payments to the contractor. Due to these reasons there are possibilities to exceed the original estimate and face a financial problem to finish the project.
3. There should be a sufficient time period to do the design part of the project. If sufficient time is not given, design of the project will end up with lot of shortcomings.
4. If computers can be used in the design stage, it will help the project in various aspects.
5. There should be a sufficient staff to carry out the design works ; so that time can be saved and ultimately this reflects as a saving in the cost.
6. There should be sufficient co-operation among parties who involve in the design stage. There should be discussions and clarifications among the client, architect, structural engineer, electrical engineer, water supply and sewerage engineer, telecommunication engineer etc

Conclusion

The design stage can be considered as the most important phase of the project. So it is essential to pay more attention in design works because any deficit which occurs at this stage will affect to its users for ever. Alternative designs can be done using the collected informations and the most suitable one can be selected by comparing them. The quality assurance, physical and financial programming etc are to be planned with utmost care as these affect the project throughout its life. It is very essential to have a fullest cooperation among the parties who involve in this task, to make the design a perfect one.

When the time factor is considered, the time to be used in the design stage is relatively very very small when compared with the life of the project. Therefore it is the responsibility of every participant to take the greatest care in this short period ; so that it will be a successful one during the balance part of the project.

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 the plans, bill of quantities and specifications prepared by the consultant within the specified time period and financial situation

Construction Document Phase

The quantities for various constructional elements and installations are estimated. The Bill of Quantities can be prepared subsequently. The proper estimate can be prepared by rating the Bill of Quantities. When the estimate is prepared, it should be submitted to the relevant officer who bears the power to grant approval for the estimate. In the Engineering Organisation, limits are fixed at different levels for approving estimates. The estimate of the project "Proposed Administration Block for Horana Hospital" was approved by the Deputy Secretary (Engineering).

Tendering Stage

After getting the estimate approved, the tender documents have to be prepared. At first, draft tender documents are prepared and it consists of the following.

1. Approved Estimate.
2. Bill of Quantities.
3. Drawings.
4. Specifications
5. Conditions of tender.
6. Article of Agreement
7. Paper notice.

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

1. Prepare pre-qualification of prospective tender and evaluation procedure.

2. Pre qualification of contractors.
3. Invitation of tenders.
4. Tender evaluation and submit a report recommending successful tenderer.
5. Prepare contract documents.
6. 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 a tender board should be three. The tender documents of the project "Proposed Administration Block for Horana Hospital" was submitted to the Cabinet appointed tender board where the authority laid.

The tender notice can be published in Newspapers after obtaining the approval for draft tender documents.

Normally, pre qualification of contractors are called for major projects and it was done for this project also. The pre-qualifications submitted were evaluated by an Evaluation committee and submitted a report with recommendations to the tender board. The members of the Tender Board go through this report carefully and approve the list of pre- qualified tenderers.

Tender forms in duplicate would be issued to the selected tenderers and they submit their bids on or before the scheduled time. The tender board opens the tender box and reads the names and their tendered amounts to enable the tenderers or their representatives to know the figures. The tender board appoints the Evaluation Committee and the tenders are handed over to them for evaluation.

The Evaluation Committee studies them thoroughly and submits a report with recommendation for the successful tenderer or sometimes with proposals for negotiations. In the project of "Proposed Administration Block for Horana Hospital" the Evaluation Committee has recommended to summon the tenderer for negotiation as his tender was more than the approved estimate. The tenderer agreed to do the project to the departmental value and the contract was awarded to that company.

Consultancy Agreement

The administration of the contract is the responsibility of the Engineer or the Consultant. The engineer is a professional, nominated by the owner to act on behalf of him. While he can be an employee of the owner, he is usually an independent Consultant commissioned by the owner, to perform the functions assigned to him, as described in the General Conditions of Contract.

If an independent Consultant is appointed by the owner, the terms of his engagement, the stages of payment of fees, etc. will be spelled out in a separate "Consultancy Agreement" between him and the owner. On a building project, this usually covers all aspects of his assignment including the planning, design, contract documentation, tender and supervision stages. It is the duty of the Consultant so appointed to take care to ascertain clearly the precise requirements of the client and to prepare in time all the detailed documentation necessary for calling for tenders, and preparing the final contract document. Contract administration often becomes difficult and can result

in confusion, if adequate attention has not been given to the preparation of the detailed documentation in time.

In the project of “The Proposed Administration Block for Horana Hospital” the agreement was signed between the Engineering Organisation of the Western Provincial Council and the contractor M/S Edward and Christie.

Construction Stage

After signing the agreement by the consultant and the contractor, the construction of the project should be commenced.

In the construction stage of a project the following aspects are to be looked into.

1. Handing over the site to the contractor.
2. Supervision or inspection of construction works / Monitor Progress of construction.
3. Co-ordinate work with client, consultants, Specialist consultants, contractor, supervisors in the Engineering Organisation, and with any other parties who are interested about the work.
4. Safety measures to be carried out at site to avoid any harm to any person or work done.
5. Quality control of the work and testing to be carried out.
6. Monitor financial progress, variation orders, extra works etc.
7. Measurements of work done.
8. Checking the bills submitted by the contractor and certification and making payments for same.
9. Litigation or Arbitration in case of disagreements.
10. Receipts of manuals and material samples.
11. Approval of construction materials according to specification.
12. Contract Administration.
13. Drawings.
14. Defects survey upon practical completion of the project and notification to the contractor.
15. Final inspection upon practical completion of the project.
16. Certification of final payment and advice client for occupation.

Contract Administration and Project Management are inter-related. The term contract administration applies to the phase of a Civil Engineering Project wherein the actual construction takes place. This is a very important phase because this is where the bulk of the owner’s money is actually spent. All parties involved to the project should be familiar with the division of responsibilities involved during the project. In this project the administration of contract is based on an important document called the “General Conditions of Contract” which is a part of the overall contract document. Once tenders have been called and a contractor has been selected, a letter of intent is issued to him to commence the preliminary work and to enter into a formal contract. Actually, the administration

of the contract is the responsibility of the Engineer or the Consultant. Administration often becomes difficult and can result in confusion, if adequate attention has not been given to the preparation of the detailed documentation in time. Project Management

The Project Management may be defined quite simply as the overall management function required to achieve the project objectives at reasonable cost and in reasonable time to the Client’s satisfaction, using all necessary inputs in terms of both professional and contracting expertise. When there are multi disciplinary inputs of professional expertise needed at the design stage and in the preparation of detailed contract documentation and where there are several contractors involved in the same project, the activities of all these will need to be coordinated as part of the overall Project Management function.

In general, in Sri Lanka for large projects where the client wishes to pay specific attention to the overall Project Management / Project Co ordination function and when he does not have “in house” engineering staff, he may wish to employ an independent consultant, independent of the firm from the principal consultant as “Project Manager”. He will not however relieve the principal consultant of any of his responsibilities. In this project the Project Management is done by the Engineering Organisation of the Western Provincial Council.

Project Planning

The project Manager is responsible for the total performance of the budget and other instructions he gets from the relevant superiors. The normal tasks of the Project Manager are

1. To present time schedules, a detailed budget and the basic conditions of the project.
2. To execute decisions from the relevant superiors.
3. To inform about the project to the interested parties.
4. To propose organisation of the project.
5. To distribute tasks within the project organisation.
6. To report progress and the problems that can not be solved to the superiors.

Organisation of a Construction Project

The construction process is a very complicated process with many different parties who are influencing the result. It is therefore very important for the client to administer his project very carefully if he wants to achieve the target of his project. Some important administration tasks which are to be completed are as follows.

1. Permission from relevant authorities have to be obtained. In the project of “ Proposed Administration Block for Horana Hospital “ authority from the Local Government for the plans were obtained. As this building includes X-Ray rooms authority was obtained from the “Atomic Energy Authority “.

2. Agreements with various parties such as contractors, consultants etc. have to be made.
3. Preparation of time schedules.
4. Cost control.
5. Progress Review meetings should be held to review the progress of the project. In the project progress review meetings are held monthly and the client, contractor and the consultant attend to them. Progress review meetings with the contractor is held fortnightly at the site by the Divisional Engineer (Horana).
6. Quality control of a project is very important. A check list has been introduced in the Engineering Organisation and every item should be checked according to the check list before giving approval to the contractor to proceed with the work.
7. Inspection of construction sites is very essential. In the Engineering Organisation there are technical officers allocated to each site and they have been instructed to supervise the work and report to the Engineer.

Almost all these tasks demand a good knowledge about the construction process and an ability to administrate. Actually, the building project manager is the manager during the whole process from briefing to completion of product. Therefore it is necessary to have a good knowledge about the project. It is essential that the manager not only control the economy of the project but also the architecture and the quality as well.

The main tasks for the building project manager are as follows.

1. To be the client's advisor in building technology and economy.
2. To control the frames of economy and time in the project.
3. To be responsible for the technical control of the project
4. To support the client when appointing consultants and contractors.
5. To administrate the tender procedure.
6. To be responsible for the contacts needed with authorities.
7. To be responsible for the needed inspections to be done.

To be able to manage these tasks, the building project manager needs to know about the following areas.

1. The procedures of authorities.
2. Design of the building.
3. Construction works including installation.
4. Construction management.
5. Cost estimating including annual costs.
6. Building management.
7. Tendering procedures.
8. The ability to cooperate.

Programming

Perhaps the most extensively used technique for the preparation of work programmes is the Bar Chart. The work programmes should reflect the intended method of operation or construction which can reasonably be expected to be followed. When preparing bar charts, attempts must be made to adequately foresee the future. Often work programmes for construction work do not take account of and allow for such things as weather patterns, national holidays, local festivals, harvesting periods etc. It is therefore very important at the beginning for contractors to submit a detailed programme of work upto completion including bar charts, net work analyses etc. which should be checked by the consultant and agreed upon. Such a detailed programme serves little purpose unless it is adequately monitored and corrective measures taken if delays are observed or foreseen.

Such delays observed and their causes should all be recorded, since the liquidated damages payable are assessed on the basis of non-allowable delays. These should be separated from the allowable delays such as exceptionally bad weather, civil commotion, non-availability of essential materials etc. If this is not done, major disputes can arise later on when quantifying liquidated damages etc.

By following up a programme the resource requirements can be identified in advance. A statement prepared by aggregating various resources such as people materials, machinery etc. in relation to the requirement of a particular resource can be presented in the form of histogram which is commonly referred to as "resource histograms". One thing that flows out from such histograms is the preparation of a month by month requirement of resources such as man power, materials, and equipment. Such histograms would enable to work out the requirement of materials such as cement, timber, sand etc. Similarly, histograms for machinery would be useful to order for hire / lease.

In the project, the work programme has been prepared in the form of bar chart and the progress is followed up according to it.

Progress Review

Regular site meetings or progress review meetings are important aspects of both Contract Administration and Project Management. All important observations and decisions taken particularly those relating to delays, additions and alterations, quality of work, measurements, complains etc. should all be recorded clearly on a site log book. A duplicate or triplicate book could be used ; so that while the book is maintained at site, copies can be kept by the consultant and the client too. Many disputes ending up in arbitration are difficult to resolve when the records are not maintained.

Quality Assurance

Quality Assurance is becoming the best management tool in the modern construction industry. Most organisations – industrial, commercial or governmental produce a product

or service intended to satisfy the user's requirements. Such requirements are often incorporated in specifications.

Quality Assurance should be a means of approaching a project:

1. By planning for the end result and best route to get there.
2. By ensuring the works / production are carried out and inspected systematically.
3. By producing documents to demonstrate that the specification for materials and workmanship have been met.

What is Quality Assurance ?

1. It is cost effective.
2. It is an aid to productivity.
3. It is a means of getting it right first time and every time.
4. It is good management sense.
5. It is responsibility of every one.

Quality Assurance is therefore a management function which can not be delegated.

For the Consultant, Quality Assurance may be necessary for one or more of the following reasons.

1. To assure reliability or public safety by structural control of all stages of design and production.
2. To provide positive evidence that the quality produced by the contractor meets that specified.
3. To demonstrate prudent expenditure particularly of public funds.

For the Contractor, there are at least three reasons for offering quality assured products. They are as follows.

1. To remain competitive.
2. To enhance the reputation of the contractor.
3. To take advantage of cost - benefit which accrues from better planning, reduced remedial work and better relationship with customers.

Quality can not be inspected into a project. It must be built in. The responsibility for quality lies with those doing for the work; the client, the planner, the engineer, the contractor, the operator and the materials used.

Benefits of Quality Assurance

The benefits of introducing Quality Assurance as a management technique into the construction process may be summarised as follows.

1. The client receives an assurance that the product he ordered has been constructed in accordance with established work and procedures using materials of specified quality.
2. The contractor's procedures become more efficient and wasteful practices are eliminated.
3. The communication among involved parties become improved as the responsibilities of them are better defined.

4. More work is produced "right first time and every time in every level", and cost savings are made because less remedial work is required.
5. Less time is lost through poor material supply, and the cost of replacing rejected materials are reduced.
6. Project information, drawings, specifications etc. are supplied by the consultant more systematically and specifications become clearer.
7. The contractor has a better chance of meeting his budget and completing the project in time. Any dispute which arises should be settled more easily by reference to the project quality records.
8. Where there is a staff turnover on site, new incumbents find it easier to check that parts of the works completed before their arrival have been carried out correctly.
9. Young Engineers gain experience with greater confidence, since written procedures they are asked to apply have been prepared by Engineers more experienced than themselves.

Quality Control

In the project of "Proposed Construction of Administration Block for Horana Hospital" the following activities are carried out to control the quality of the construction work.

1. The quality of all materials are checked before using for the construction work.
2. The contractor has been instructed to submit samples of materials for approval before purchasing.
3. Samples of certain materials are tested in other institutions where approval can not be granted by visual observation. For example, samples of certain timber species, steel, aluminium sections etc. are sent to various institutions for testing before giving approval.
4. Samples of concrete test cubes are submitted for testing to other institutions.
5. Supervising officers are instructed to follow a check list when carrying out their supervision. The check list is prepared in a format which includes every detail which should be looked into when checking the materials or work.
6. The contractor is instructed to follow the specifications.

Economic Control

One of the important responsibilities of the Consultant during the Contract Administration stage is the approval of measurements and bills submitted periodically by the contractor. The basis for such approval is the rates given in the Bill of Quantities and the actual quantities or work done as jointly measured and checked by the contractor or his representative and the consultant.

The bills for the work done should be submitted monthly by the contractor with measurement sheets and all

other supportive documents such as claims for fluctuation of materials, receipts etc. The bill should be submitted in the forms issued by the consultant. The Engineer or the consultant employs a competent technical officer to check the bill. The consultant should check the bill as early as possible and make the payment to the contractor. If the contractor is not paid promptly it is difficult for him to organise his work. The project of "The Proposed Administration Block for Horana Hospital" is a measure and pay contract and payments are to be made monthly for the work executed during that period.

Insurance

The contractor has to insure the work and workmen of the project. The insurance should be made to be valid during the construction period as well as during the defects liability period. In case of giving extensions to the contract period, the validity of insurance should also be extended. It is necessary to check whether the insurance is in force before making payments to the contractor.

Mobilisation Advance

Normally 20% of the contract sum is paid to the contractor as the Mobilisation Advance in Civil Engineering projects. If a Mobilisation Advance has been agreed upon in tender condition, it may be paid to the contractor against a suitable Bank Guarantee. The bank guarantee safeguards the mobilisation advance given to the contractor. The contractor is supposed to use this money only for the execution of the project. The contractor has to submit the document to show the manner how he is intended to use this money together with his request for the advance.

A mobilisation advance of Rs.6,393,000 was paid to the contractor of the project of "The proposed Administration Block for Horana Hospital".

Performance Bond

When it is decided to confirm the acceptance of tender, a letter of acceptance has to be sent to the contractor. The successful tenderer has to submit a Performance Bond as described in the tender documents before signing the contract agreement with the consultant / client. The performance bond will help to ensure the proper performance of the contract by the contractor.

The performance bond is 2.5% of the contract sum. The contractor submitted a performance bond of Rs.799,125 for the project of "The Proposed Administration Block for Horana Hospital".

Liquidated Damages

Liquidated Damages are to be charged from the contractor for the delays over the date of completion. Records should be maintained at site for the allowable or unforeseen delays for which the contractor is not to be held responsible. The liquidated damage for a day is 1/4000 of the contract sum.

The contractor of the project "The Proposed Administration Block for Horana Hospital" will have to pay Rs.800 per day for any delay over the accepted date of completion

Retention Money

10% of the payments from every interim bill are usually held up to a maximum of 5% of the contract sum as Retention Money. When the final bill is paid 50% of this is released and the balance 50% will be released only after the defects liability period which is normally a one year. This will be paid, only if all defects observed and informed to contractor have been remedied by the contractor and if it is certified by the engineer.

For the project of "The Proposed Administration Block for Horana Hospital" the amount of retention money to be held is Rs. 1,598,250.

Maintenance Stage

After proper completion of the project, the contractor hands over the project to the consultant or to the client to whom he has signed the agreement with. If the project is handed over to the consultant, he in turn hands it over to the client for its use. According to the agreement, the contractor is still responsible for the defects of the work he carried out in the project. The following activities should be looked into during the maintenance period.

1. Supervision / Inspection of works during defects liability period.
2. Inspection at the end of the defects liability period and inform to the contractor for rectification.
3. Release of retention money.
4. Issue of final certificate on completion.
5. Inform the client to be alert on functions and to report if any. Experiences to use in future projects

The production stage of a project is very important and attention should be paid to the following items.

1. The contractor should adhere to the plans and specifications issued by the consultants.
2. The contractor should employ skilled labour force to construct the building.
3. The quality of materials as well as the quality of the constructed works should be looked into. This can be done by getting approval for samples of materials in advance from the consultant.
4. It is preferable if approval could be obtained from the consultant for the construction method before doing the work.
5. A close supervision has to be carried out more frequently ; so that any mistake done by the contractor could be rectified then and there.
6. It is very good if the architect visits the site frequently to ensure that the construction work of the building is done by the contractor as per the plans and the quality specified.

Conclusion

The construction stage is also equally important as the design stage because this is the phase at which the designer's designs will come into reality. How much good the designer completes his/ her work, it is of no use if the contractor fails to perform his duties well. Therefore every effort should be taken to look into every aspect that affects the construction works of the project. The proper quality control, financial control, progress control and managerial control are the best tools that can be used to get a quality product in time.

Property Management

Generally in Sri Lanka, almost all the government institutions are housed in buildings which are owned by the government. There are certain cases where government offices are functioned in private buildings. Likewise, most of the dwellings are owned by the occupants and there are houses which are rented out for tenants.

However, whatever the case it is, the government does not have a burden for property management other than government buildings. Funds are allocated to every ministry to maintain the buildings which are coming under it. The government funds can be utilised for renovations or maintenance only if the building is belonged to the government. If the government offices are held in private buildings, maintenance of these buildings have to be done by the owner or the land lord of that building as per the agreement he/she has entered into when leasing his/her building to the government.

The maintenance of government buildings are carried out when and where necessary. All ministries prepare the priority lists for the maintenance of all buildings under them at the beginning of the year.

Property Management of government buildings in the Western Provincial Council

The Engineering Organisation of the Western Provincial Council prepares the estimates for the maintenance works of government buildings belonged to the Western Provincial Council, when the requests are made by clients. Always the client is a government institution. In this way, all provincial ministries get the required estimates for maintenance works of their buildings. After getting all estimates for maintenance of their buildings, the priority list is prepared by each ministry to suit to the funds allocated to that ministry by the government. Provincial ministries have the authority to carry out maintenance work upto Rs. 500,000. When the estimate exceeds Rs. 500,000, funds will be released to the Engineering Organisation and it has to do the maintenance works with its supervision. The contractor is selected to do the work by following the tender procedure.

This procedure is followed to do the normal maintenance works of government buildings. When the funds are allocated to ministries, a part of it is kept reserved to

enable to attend to any urgent repair of building in case of urgent need. For example, if a tree is fallen onto a roof during heavy rains and the roof is collapsed, immediately it will be rectified by using that reserved funds.

Property Management of private buildings

In case of private buildings, most of which are owned by occupants have to be maintained by themselves. There are few who have rented out the houses owned by others. Even the rented houses are maintained by the owner. There is no hard and fast rule for the maintenance of private property. The owner is very keen in this matter and try to keep his /her building in good condition. Therefore, owners always try to get any defect rectified then and there without allowing them to be accumulated. The only problem faced by the owners are that they don't have sufficient money to maintain their properties. Eventhough people can get money as loans, people are reluctant to get loans mainly due to two reasons.

1. The high interest rate to be paid.
2. The tedious procedure to be followed to apply for a loan.

These reasons discourage people to get loans. Therefore people are unable to maintain the property as they want and somehow or other they manage to do their best with which they can afford.

Conclusion

When a building project is considered, the time used for the design and the construction is relatively very very small when compared with its life time. Therefore if proper attention is not paid within this short period, the user or the owner will have to suffer for a very long period till that product or building exists. Therefore in a country like Sri Lanka every effort should be taken by the consultants and contractors to construct quality buildings which will give very low maintenance costs to the owners.

Problems encountered in the project

1. When carrying out feasibility studies for this project, the land available for this building was very restricted. Therefore a plan was drawn to suit to the land available.
2. The time allowed to prepare the drawings, bill of quantities and estimate was not sufficient as there was a political pressure to commence the work immediately.
3. At the beginning, soil was tested by digging trial pits. But while executing the work, the necessity of further investigation if soil was arisen. Later on soil condition was investigated by soil experts.

4. The Structural plans were altered as per the later investigation of soil. This caused delay in contractor's work.
5. Due to the unfavourable weather condition prevailed at the beginning of the work, the excavation of foundation and removal of bad soil could not be carried out as per the programme. In addition, there was a scarcity of sand due to heavy rains prevailed.
6. There is no space to store materials such as sand, metal, bricks etc. at site. Therefore it is very difficult to supply materials to site in advance to avoid shortage of them.
7. There was a shortage of steel for some time.
8. There was a delay in making payment to the contractor at the beginning of the year as the funds were not received by the provincial council from the central government promptly at the beginning of the financial year. This is beyond the control of the consultant as well as the client.
9. Due to non availability of computer support at the design stage and due to shortage of staff to carry out manual work, a great effort was used to get the work done as scheduled.

Experiences to use in future projects

1 Adequate analysis in the early stages

In the construction industry carried out by the Engineering Organisation of the Western Provincial Council, it is often found, the analysis carried out in the early stages of projects is not sufficient. This may be due to various factors such as time, lack of co-operation among parties involve, political influence, insufficient amount of funds, high cost relating to investigations, poor knowledge, shortage of staff etc. What ever the reason it is, this effects badly to its final product both in quality and economy and ultimately the objective of the project is not properly achieved.

2 Sufficient economic control during the design stage

The estimates for the construction of projects are carried out at the design stage. But annual cost estimating or life-cycle costings are not prepared for these projects. It is advisable to prepare these estimates also for the projects which are carried out by the Engineering Organisation.

3 Architects on construction sites

The architect of Engineering Organisation takes the responsibility only for the architectural drawings prepared by him / her. The engineer is fully responsible for the entire construction work done by the contractor. Actually, it is very good if certain responsibility is fixed to the architect ; so that the architect can visit the site during the construction period and advise when and where necessary.

4 Sufficient information to the user

The traditional documentation such as drawings, bill of quantities, specification etc. of a construction project is supposed to be prepared by the consultants. The average user of the future building has not the knowledge to understand these documents. However, if the consultant can take the trouble to discuss and educate the client or the average user about the details of the project at the design stage, it would be very much successful to achieve the goals of the project and at the same time to avoid future complains that will arise in using the building. Therefore it is very necessary to integrate various interested parties into the process at the early stage.

5 The lack of computer support

Almost all the works in every stage of projects are carried out manually in the Engineering Organisation of the Western Provincial Council. Fortunately, computers were received some time back and gradually the usage of them are improving. If computer support can be obtained for the works in every stage of the project, it will be very useful to expedite the activities in the construction industry.

6 Quality Management

Every effort is taken by the Deputy Secretary (Engineering) who is the technical head of the Engineering Organisation to get a quality product at the end of a project by giving instructions to his subordinates, such as to carry out close supervision, to follow check lists when approving works or materials, to check materials, to test finished products etc. What ever the attempt is taken by the technical staff, ultimately it finds if the capability of the contractor is inadequate, satisfactory quality of work can not be obtained at the end. Therefore it is very necessary to select a capable contractor through the tender procedure.

7 Resistant to Changes

It is often found in the government sector, the government officials are extra conservative and resistant to changes. Also, it is found if any new technique is adopted unfortunately it will end up with some sort of problems. This discourages the officials to try into new techniques or to be innovative in construction industry. However, there should be a way to implement and absorb new technology into our construction industry.

8 Good Training for Workmen

In practice, it is found, ultimately the quality of the work is the capability of the contractor. The contractor gets the work done by the workmen. No matter what efforts are made by the client, no matter how the work is supervised by the technical staff or the consultant, if the workmanship is bad, satisfactory quality of work can not be produced. In this regard, it is very essential to train the workmen very well. It is very much better, if they can be trained in theoretical subjects as well as in handicraft.

9 Training of Technical Staff

The construction works carried out by the contractors are supervised by a technical staff which includes engineers

and technical officers in different grades. At present, there is an institute called “The Institute for Construction Training and Development” in our country. It conducts training classes to engineers and technical officers at this institution. It is very much better if this training can be decentralised and brought to site levels.

10 Delegating the responsibilities to the labourers

In Sweden, it is found, the responsibility of the construction industry is delegated to the labourers. The author admires this situation and accepts it as a very correct step taken at the Swedish construction industry. It is very clear, that the labourer enjoys a moral inspiration by getting the intention that he is also an important part of the ultimate product. Still the author finds it difficult how this can be incorporated in the construction industry in Sri Lanka. However it is decided to forward this proposal to superiors to think of a way to make a start.

11 Improve the co operation - Decrease the antagonism

When looking at the construction process and its participants, it is obvious that there is a state of opposition among many groups of interests. This may be between client and contractor, contractor and sub-contractor, consultant and contractor, engineer and architect, project engineer and head office staff etc. However, this collision should be minimised to the very bottom and co-operation among participants should be developed. This leads to a good quality product at the end.

12 Establish Audit Organisation

It is advisable to establish an audit organisation to look into the construction industry to check the waste of public funds through malpractices and negligences. This proposed organisation should look into complains from consultants, contractors, clients, other government officials and the public, relating to such things as unfair selection of contractors, undue pressure or influence for activities of contract, payment of illegal commission and so on.

Conclusion

It can be said that the construction management of a project is successful, if and only if the prime objective of a project is achieved. That is, the project should be satisfactorily completed within the specified period, without unreasonable escalation in costs. There must be a spirit of co-operation shown by all the parties involved.

A Consultant while looking after the Client’s interests must use his independent professional judgement to be fair to the Contractor and to understand his problems and to provide him with all the information required to proceed uninterrupted. The Contractor too must extend his co-operation to the Consultant by being willing to use all his resources to perform in terms of his contract and to produce results. The Client must be willing to act on the advice of the Consultant and have the financial resources necessary to pay the Contractor on time. If there are unreasonable delays and gross escalation in cost, these are

usually indicative of ineffective Construction Management.

If the division of duties and responsibilities of each party as spelled out above, are understood and if Professionals and Contractors are capable of performing adequately about their respective functions, they will provide a good foundation for the owner to build upon and to ensure that his interests are adequately safeguarded and the goals of the project are achieved.

Contractors should register their construction companies in the Institute for Construction, Training and Development, and these companies get their grades according to their capabilities. It is very good if “ICTAD” can arrange training programmes to improve the knowledge of contractors.

However professionals should also be given training in construction industry to update their knowledge. The International Construction Management Course serves a great deal in this regard as it gives an opportunity to professionals to learn from veterans and share the knowledge of other participant professionals from all over the world.