

**A CRITICAL STUDY OF MAJOR CONSTRUCTION  
PROJECTS IN KERALA VIS-A-VIS EFFECTIVENESS IN  
PROJECT IMPLEMENTATION**

*A THESIS*

*Submitted by*

**V. H. ABDUL SALAM**

*For the award of the degree*

*of*

**DOCTOR OF PHILOSOPHY**

**SCHOOL OF ENGINEERING  
COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY  
COCHIN - 682 022**


**NOVEMBER 1999**

*Dedicated to  
My grand - daughter Parzu*

## CERTIFICATE

This is to certify that the thesis entitled "**A CRITICAL STUDY OF MAJOR CONSTRUCTION PROJECTS IN KERALA VIS-À-VIS EFFECTIVENESS IN PROJECT IMPLEMENTATION**" is a report of the original work carried out by Shri. V.H. Abdul Salam, under my supervision and guidance in School of Engineering. No part of the work reported in this thesis has been presented for any other degree from any other institution.

Cochin - 22  
15.11.1999

  
Prof. (Dr.) Babu T. Jose  
Supervising Guide,  
Head Department of Civil Engineering and  
Director, School of Engineering,  
Cochin University of Science & Technology.

## **DECLARATION**

I hereby declare that the work presented in this thesis is based on the original work done by me under the supervision of Prof. (Dr.) Babu T. Jose, Head, Department of Civil Engineering and Director, School of Engineering, Cochin University of Science and Technology, Cochin, in School of Engineering. No part of this thesis has been presented for any other degree from any other institution.

**COCHIN - 22**

**15.11.1999**



**V.H. ABDUL SALAM**

## ACKNOWLEDGEMENT

*"All praise to the Almighty, the most merciful and compassionate for His blessings throughout this work"*

I acknowledge my deep sense of gratitude to my supervising guide Prof. (Dr.) Babu T. Jose, Director, School of Engineering for his technical guidance, advice and constant encouragement during the various phases of this work.

I place on record my profound gratitude to Dr. T.V. Jacob, Chief Engineer (Retd.), Kerala Water Authority for his valuable advice, untiring enthusiasm and unstinted support throughout the course of this work. I express my heartfelt thanks to the faculty members of the School of Engineering, Cochin University of Science and Technology, especially to Dr. Benny Mathews Abraham, Reader, for the help extended to me in all matters connected with this.

I acknowledge my sincere gratitude to Shri. V.J. Kurian IAS, Managing Director, Cochin International Airport Ltd. and Shri. A.M. Shabeer, Executive Engineer (Civil), CIAL, who have furnished to me all the required data about the Nedumbassery International Airport.

Dr. Thomas Mathew IAS, former Managing Director, Kerala State Construction Corporation, Shri. V.R. Bhaskaran Nair, former General Manger, KSCC, Shri. T.S. Krishna Moorthy, Secretary, KSCC and Shri. Manoharan, P.A. to M.D., KSCC who have furnished the required details of the project of Kerala Legislature Complex, deserve special mention for their sincere co-operation.

I thank Er. E. Kurien Mathew, M.D., Asian Techs most sincerely for the help and valuable advice given by him during this work.

The help and assistance rendered by Shri. John Thomas, Section Officer, School of Engineering, Smt. Clara Vandreck, Typist and Shri. P.A. Aboobacker and Sri. Purushothaman, Staff of Geotechnical laboratory are gratefully acknowledged.

**V.H. ABDUL SALAM**

# CONTENTS

PAGE NO.

ACKNOWLEDGEMENTS

LIST OF TABLES

LIST STATEMENTS

LIST OF FIGURES

LIST OF PHOTOGRAPHS

<b>CHAPTER - 1</b>	<b>INTRODUCTION</b>	<b>1</b>
1.1	The Construction Industry	1
1.2	The Problem and the Relevance of the Study	5
1.3	Area of Investigation	7
1.4	Objectives of the Study	8
1.5	Scope of the work	8
1.6	Abstract	9
<b>CHAPTER - 2</b>	<b>LITERATURE SURVEY</b>	<b>11</b>
2.1	Introduction	11
2.2	Construction Management	12
2.3	Cost & Time Overruns in Projects	14
2.4	Relevance of Technology Adoption	16
2.5	An Approach towards Effective Project Management	17
2.6	Fluctuation Clauses	19
2.6.1	The Tender Condition No.28-CMDS (G.C.D.A.)	21
2.6.2	The Contract clause of CPWD	22
2.6.3	The tender condition No. 32-A of N.V.D.A (M.P)	26
2.6.4	Tender condition of T.N.E.B. (Chennai)	29
2.6.5	Fluctuation clauses in ADB Project	32

<b>CHAPTER - 3</b>	<b>TIME AND COST OVERRUN IN CONSTRUCTION: AN ANALYSIS</b>	<b>43</b>
3.1	Introduction	43
3.2	National Scenario	43
3.3	Time and Cost Overrun in Projects in Kerala	49
3.4	National Loss on account of Delay in Construction	63
3.5	Unworkable Estimate	65
3.5.1	Equation for the Correction for actual Market Rates	66
3.6	Selection of Competent Contractors - Lowest Quotation Approach	69
3.6.1	Need for a Model Procedure for the Selection of a Contractor	70
3.6.2	Bid Capacity of a Contractor	70
3.6.3	Selection of Contractors through Performance Rating	78
3.6.4	How to eliminate a Litigant Contractors	82
3.7	Exploitation of Faulty Price Variation Clause.	82
3.7.1	Inclusion of Price Variation Clause in Tender Documents - A Fair Deal	82
<b>CHAPTER - 4</b>	<b>EFFECTIVE CONSTRUCTION MANAGEMENT - SOME TYPICAL CASE STUDIES</b>	<b>87</b>
4A.	KERALA LEGISLATURE COMPLEX	87
4A.1	Introduction	87
4A.2	Phase - I	87
4A.3	The Administrative Block - Salient Features	88
4A. 4	Phase - 11	88
4A.5	Construction of Legislative Assembly Building	92
4A.6	Execution of the work of Legislature Complex through Kerala Public Works Department	97
4A.7	Organizational Set up of the P.W.D.	97
4A.8	Kerala State Construction Corporation Ltd. - The Main Contractors of the Legislative Assembly Building	99
4A. 9	The Capital	99

4A.10 The Works	99
4A.11 Monitoring of the Work of Assembly Building	100
4A.12 Statement of Accounts of Bills	101
4A.13 Composition of KSCC	104
4A.14 Implementation Effectiveness in the Project of Kerala Legislature Complex	106
4A.15 Perceptions by the Subordinates	106
<b>4B. INTERNATIONAL STADIUM AT COCHIN - A SPORTS PROJECT OF GREATER COCHIN DEVELOPMENT AUTHORITY</b>	<b>110</b>
4B.1 Introduction	110
4B.2 Commencement	111
4B.3 GCDA- Organisational Set up and Resource Position	112
4B.4 Objectives	118
4B.5 The Site	119
4B.6 Anticipated Commercial Viability	119
4B.7 Selection of Architects	120
4B.8 Some Engineering Details of the Project	121
4B.9 Circulation	123
4B.10 Structure	123
4B.11 Salient Features	126
4B.12 Finalisation of Contractors for Construction of Stadium Project	129
4B.13 Negotiation between Hindustan Steel Works Construction Ltd. and Greater Cochin Development Authority	133
4B.14 Construction of International Stadium at Cochin: Compliance of Preliminary Requisites	134
4B.15 Selection of Sub-Contractors	136
4B.16 Commencement of the Stadium Work	137
4B.17 Remedial Measures taken to Accelerate the Progress of the Work	138
4B.18 Implementation Committee	140
4B.19 Pile Load Tests-Static and Dynamic Testing	140



4B.20	Project Implementation	141
4B.21	Review of Progress - Daily Meetings	141
4B.22	Construction of Mainframe & General Building Work	142
4B.23	Construction of Precast Prestressed Gallery Seating Elements	142
4B.24	Quality Control	144
4B.25	Electrical Works and Arena Lighting	145
4B.26	Pump and Underground Sump Room	146
4B.27	Sewerage Treatment Plant	146
4B.28	Equipment Used	147
4B.29	Extension of Time of Completion of the Stadium	147
4B.30	Excellent Performance of GCDA	150
4C	CONSTRUCTION OF COCHIN INTERNATIONAL AIRPORT, NEDUMBASSERY	151
4C.1	Introduction	151
4C.2	Background	152
4C.3	Formation of Cochin International Airport Ltd.	155
4C.4	Project Cost & Financing Pattern	155
4C.5	Composition of CIAL	156
4C.6	The Main Contractors	157
4C.7	Important Structures/Facilities in Phase - 1	162
4C.8	Runway, Taxiway and Apron	162
4C.9	Domestic & International Terminals	162
4C.10	Car Par	163
4C.11	Cargo Terminal	163
4C.12	Air Traffic Control Tower	163
4C.13	Fire Station, Substation, Instrument Landing System and the other Infrastructures	164
4C.14	Other facilities	164
4C.15	Monitoring Mechanism	165
4C.16	Consultants	165
4C.17	Supervision and Control of Execution	165
4C.18	Phase - 11	166

4C.19 Land Acquisition - A Social Problem	166
4C.20 Network to Nedumbassery	169
<b>CHAPTER - 5 DISCUSSIONS AND RECOMMENDATIONS</b>	<b>170</b>
<b>5.1 Discussion on the Implementation of the Project -     Kerala Legislature Complex</b>	<b>170</b>
5.1.1 Strong Project Team and Leadership	172
5.1.2 Perceptions of the Subordinates	173
<b>5.2 Discussion on the Implementation on International Stadium     project at Cochin</b>	<b>175</b>
5.2.1 Perceptions of the Contractors	177
5.2.2 Dangers from Unbalanced Profit Distribution	178
<b>5.3 Discussion on the Implementation of Cochin International Airport at     Nedumbassery.</b>	<b>192</b>
5.3.1 A Revision in the Land Acquisition Act Needed	194
5.3.2 Factors behind the Success Story	195
5.4 Analysis of Delays in Projects	196
5.5 Time Overruns in a Project	200
5.6 Cost Overruns	201
5.7 Some Remedial Measures for Speedy Implementation of Projects	202
5.8 Project Management	205
5.9 Effectiveness in Project Implementation	205
5.10 Traits of Successful Project Leader for Better Effectiveness	211
5.11 New Trends in Project Management	218
5.12 Contract Management	219
5.13 Construction Management	222
5.14 Cost Control	228
5.15 Cost Effectiveness through Construction Management in Housing Construction	228
5.16 Schedule Control	234
5.17 Management Techniques in Indian Construction Industry	234

<b>CHAPTER - 6</b>	<b>CONCLUSIONS</b>	<b>235</b>
6.1	<b>Equation for the correction of an Estimate to make it Workable and Realistic</b>	<b>235</b>
6.2	<b>Selection of Competent Contractor</b>	<b>236</b>
6.3	<b>Role of Coefficient of Uniformity in Profit Distribution in the Finalisation of Contracts</b>	<b>239</b>
6.4	<b>The Role of Project Leader</b>	<b>241</b>
6.5	<b>Human Dimensions - A must for Improved Dynamism</b>	<b>242</b>
6.6	<b>Efficient Project Manager</b>	<b>242</b>
6.7	<b>Price Variation Clause in Tender Documents</b>	<b>242</b>
6.8	<b>A Revision in the Land Acquisition Act Needed</b>	<b>243</b>
6.9	<b>Introduce a System of keeping History Sheets of Contractors</b>	<b>244</b>
6.10	<b>The Undesirable Contractor should be eliminated</b>	<b>245</b>
<b>REFERENCES</b>		<b>246</b>
<b>LIST OF PAPERS PUBLISHED/ACCEPTED</b>		<b>251</b>

## LIST OF TABLES

TABLE	PAGE
1.1 Construction Content of Plans	1
1.2 Investment and Increment in GDP (1982-85)	2
1.3 Central Plan Outlay	3
3.1 Extent of Time & Cost in Projects with respect to latest Schedule	44
3.2 Time Frame for Normal Projects	45
3.3 Cumulative Escalation	68
4.1 Salient Aspects of Legislative Assembly Building	92
4.2 Plinth Area Details	93
4.3 Executive Committee of the Greater Cochin Development Authority during Construction of the Stadium.	113
4.4 General Council of the Greater Cochin Development Authority during Construction of the Stadium	114
4.5 Board of Management for the Stadium Construction	117
4.6 Advisory Committees.	118
4.7 Anticipated Sources for Project Funding	120
4.8 Salient Features of the Stadium	126
4.9 Details of Sub -Heads of Works	137
4.10 Equipment used for the Construction of the Stadium	147
4.11 Cochin International Airport - Details of main Civil Works	158
4.12 Details of Electrical Works	160
4.13 Details of Operation Works	161
5.1 The Extent of Fluctuation for Normal Items	179
5.2 Details of Payment of Civil Works to Contractors	182
5.3 Average Weightage as per Analysis	229
5.4 Construction Possibilities	232

## **LIST OF STATEMENT**

- |             |  |            |
|-------------|--|------------|
| <b>I.</b>   | <b>Statement for determining 'A' value i.e. The maximum value of Civil Engineering Works executed in any one year during the last five years which will taken into account the completed and ongoing works</b> | <b>72</b>  |
| <b>II.</b>  | <b>Statement determining 'B' value, the value of existing commitments and Ongoing works to be completed during the period stipulated for completion of proposed work</b>                                       | <b>73</b>  |
| <b>III.</b> | <b>Accounts of Bills Legislative Assembly Building</b>   | <b>101</b> |

## LIST OF FIGURES

<b>FIGURES</b>	<b>PAGE</b>
3.3.1 Construction Cost - Kakkad Project	50
3.3.2 Construction Cost - Muvattupuzha Valley Irrigation Project	58
3.5.1 A graph of Year of construction Vs. Escalation percentage	67
4 A. 4.1 Legislative Assembly Building - Front Elevation	89
4 A 4.2 Legislative Assembly Building - Plan	90
4 A 4.3 Legislative Assembly Building - Section	91
4 B 3.1 Organisational Set up of GCDA	116
4 C 2.1 Greater Cochin Development Authority Area	154
5.2.2.1 Curve based on the Quarterly Payment in the Construction of a Stadium at Cochin	185
5.2.2.2 Curve showing the Profit/margin - A Stadium at Cochin	186
5.2.2.3 .Curve showing Investment and Payment - A stadium at Cochin	187
5.2.2.4 Profit Curves - A stadium at Cochin	188
5.2.2.5 Curve showing Front/Rear Loading Effect of the Contract - A stadium at Cochin	189
5.15.1 Comparison of Weightage for Building Cost Index	231
5.15.2 Construction Stagewise Distribution for Traditional and Low Cost Housing	233

## **LIST OF PHOTOGRAPHS**

<b>1. Kerala Legislative Assembly Building at Thiruvananthapuram.</b>	<b>105</b>
<b>2. A view of the magnificent Central Assembly Hall of the Legislative Assembly Building.</b>	<b>105</b>
<b>2. Inside view of the Jawaharlal Nehru International Stadium at Cochin.</b>	<b>149</b>
<b>3. A Section of Spectators watching the Inauguration function of the International Stadium at Cochin.</b>	<b>149</b>
<b>4. City side View of the Passenger Terminals with spacious Car Park facility in the front at Cochin International Airport.</b>	<b>167</b>
<b>5. Air Traffic Control Tower-One of the Tallest in the Country is under construction.</b>	<b>167</b>

## LIST OF ABBREVIATIONS AND SYMBOLS

AIR	All India Radio
BOO	Build, Own & Operate
CIAL	Cochin International Airport Limited
CMD	Chairman and Managing Director
CPM	Critical Path Method
CUPD	Coefficient of Uniformity in Profit Distribution
CAG	Controller and Auditor General
E	Estimated Cost
GCDA	Greater Cochin Development Authority
GDP	Gross Domestic Product
HSCL	Hindustan Steel works Construction Limited
HP	Horse Power
HUDCO	Housing and Urban Development Corporation
KSCC	Kerala State Construction Corporation
KSEB	Kerala State Electricity Board
KWA	Kerala Water Authority
MC	Maximum Credit
NH	National Highway
NRI	Non Resident Indian
NICMAR	National Institute of Construction Management And Research
OMC	Optimum Moisture Compacted
Pp	Percentage of P.O.L. component
P <sub>1</sub>	Performance factor for technical skill and infrastructure
P <sub>2</sub>	Performance factor for reliability
P <sub>3</sub>	Performance factor for timely execution of projects
P <sub>4</sub>	Performance factor for cost effectiveness
T <sub>s</sub>	Grade Point for Technical Skill
T <sub>i</sub>	Grade point for Infrastructure
V <sub>m</sub>	Variation in Material cost
V <sub>L</sub>	Variation in Labour cost
V <sub>F</sub>	Variation in P.O.L. component
WIO	All India Wholesale price index for all commodities on the date of agreement
δ	delta
Σ	cap. sigma



# CHAPTER - 1

## INTRODUCTION

### 1.1 THE CONSTRUCTION INDUSTRY

Construction industry is the second largest (next to agriculture) economic activity in India, providing employment to about 3.1 crore persons and helping to develop infrastructure in a big way. The contribution of the construction industry to the national income is Rs. 2.10 lakh crore, which is about one-sixth of India's GDP. Twelve percent of the budget-revenues comes from the construction industry. The capital outlays on construction in successive Five year Plan of India have been in the range of 36% to 50% of the national outlay, out of which nearly one-half goes for construction of buildings and allied services (Table 1.1)

**Table 1. Construction Content of Plans**

Plan period	Construction content as percentage of Total Development plan outlay
First Plan (1951 - 56)	50.4
Second Plan (1956 - 61)	42.6
Third Plan (1961 - 66)	42.3
Fourth Plan (1969 - 74)	43.2
Fifth Plan (1974 - 79)	43.4
Annual Plan (1979 - 80)	46.1
Sixth Plan (1980 - 85)	36.2
Seventh Plan (1985 - 90)	40.0
Eighth Plan (1990 - 95)	44.0
Nineth Plan (1997 - 2002)	46.0

As a capital goods industry, construction plays an important role in economic growth through the multiplier effect on other sectors of the economy. There is hardly any

sector which does not have construction component. It varies from 10 to 20% in scientific research and education, to 40% in transport and communication, 75% in power, 80% in irrigation and flood control, and to 100% in housing.

A significant feature of this industry is its catalyst role, as every rupee invested in construction generates incremental GDP to the tune of 78 paise. The corresponding figures for agriculture and manufacturing are only 20 paise and 14 paise, respectively (Table 1.2)

**Table 1.2 Investment and Increment in GDP (1982 - 85)**

	Investment at Market Prices (Rs. crore at 1979 - 80 prices)	Increment in GDP at Factor cost (Rs crores at 1979 - 80 prices)	Incremental GDP per Rs of investment (paise)
Construction	1760	1389	78
Agriculture	32242	6404	20
Forestry and logging	478	327	68
Mining and quarrying	6575	1040	16
Manufacturing	45515	6500	14
Railways	4724	420	8
Transport other than Railways	11330	1025	9
Communication	2902	262	9
Trade, Storage and ware housing	7299	5026	69
Banking and insurance	260	968	370
Source: Sixth Five Year Plan, 1980 - 85			

The Eighth Plan document, in its 19<sup>th</sup> chapter on "Plan Implementation and Evaluation", has dealt with 'Construction Sector'. The focus is on some of the common and general steps to be taken to improve the efficiency in the process of formulation, implementation, monitoring and evaluation of projects and programmes. These are important for the construction sector as construction forms a part and parcel of every development activity. The delays in projects will affect employment opportunities, loss of scarce resources and contribution to economic growth.

Today construction has reached a stage where it can stand up to international standards and competition. It is poised for growth, and can make a mark in the world market, provided it becomes more competitive domestically by way of improving productivity and effectiveness, by reducing costs, introducing latest technology and of course by the provision of more funds. Construction activity therefore plays a catalyst role, and is not only an element in economic activities, but by itself creates both backward and forward linkages in the rest of the economy. In other words, it has an economic multiplier effect.

The construction component in the Energy and Transportation heads of the National Plan Outlay is 75% and 40% (excluding Railways) respectively. From Table 1.3 it may be seen that the sum of the outlay figures for the Energy and Transportation sectors is almost exactly 50% of the total. Add to this the construction element which is implicit in all the other items of the Plan expenditure, and it will be seen that the "Big Three" of development are Energy, Transportation, and construction, which together easily account for over 70% of the total plan outlay.

**Table 1.3 Central Plan outlay (crores of rupees)**

	1991 - 92 BE	1992 - 93 BE
Agriculture	1858	1879
Rural development	2702	2610
Irrigation and Flood control	267	213
Energy	13514	14998
Transportation	7537	9129
Industry and Minerals	7117	8189
Communication	3383	4890
Science, Technology & Environment	961	935
Social Services	4957	5128
Others	673	409
Total	42,969	48,407

Source: Hindustan Times New Delhi March 2, 1992, p. 12

BE: Budget Estimate

The construction industry is concerned with building construction and developmental and infrastructural projects, and provides the most visible aspect of development towards greater industrialisation. Economic stability requires that the Big three remain in mutual equilibrium.

Construction is synonymous with civilization. It has been so over the ages. It is therefore natural that the progress of any society or a nation, whether it is looked from the angle of one programme or the other, involves construction in one form or another. Any construction to fructify would need three essential components - materials with which to make the construction; the manpower to do the construction; and the know-how with a view to complete the construction in a safe and satisfactory manner with minimum expending of resources and in the fastest possible time.

The construction industry is the world's largest and the most challenging dynamic industry. It is also quite complex in as much as it involves interaction and co-ordination of skills and efforts of a large number and variety of agents. Due to this inherent complexity, construction project management is both an art and a science. In the competitive construction market, owing to changing characteristics of modern design, it seems that 'good management' is taking the place of 'time management' which was generally adopted by the construction industry in the past decade. The increasing complexity and competitiveness in construction projects around the world has necessitated the use of mechanised equipment for their speedy and accurate execution.

We are now on the threshold of entering the next millennium. About Rs. 26,90,000/- crores is estimated to be spent during 1995 - 2005 in India on construction activity - an activity which is required in almost all facets of development. An efficient and responsive construction management both in the private and public sector and the assurance of specified work's quality are must for the construction industry to survive stiff competition at home and abroad. The engineers in the country have a very important role to play for speedy and economical execution of projects, particularly for a developing country like India.

Unfortunately, the management of this industry has not improved to the desired extent due to several constraints. There is a dire need of improvement by proper organization, planning, decentralization and adoption of improved management techniques. This is necessary to create a better and congenial environment and render adequate service to society. Maximizing profit is commendable but only when it is achieved through technical excellence, administrative efficiency and quality assurance. It is not possible for a successful and efficient construction manager to ignore the present inflationary trends and that this evil must be constantly checked. It is imperative for the manager to find out ways and means to innovate new methods and techniques in the management of construction to effect maximum economy in every sphere without sacrificing quality and safety. The efficiency of construction management implies effective management, whole hearted devotion and absolute integrity. It is also necessary for successful manager to be free from any external interferences.

## **1.2 THE PROBLEM AND RELEVANCE OF THE STUDY**

A critical analysis of a few major civil engineering projects taken up for execution during the last five decades has indicated that there has been considerable cost and time over runs in most of the projects. The costs of the projects increase by several times and accrual of benefits gets delayed, resulting in further financial losses and retarding the overall economic growth in the country. This becomes a major cause of concern and upsets the process of planning.

### *Delay in the execution of projects:*

Project over run is a serious economic problem in the developing countries where project implementation takes place in the face of many uncertainties.

As on 1<sup>st</sup> of January, 1992, there were central sector projects costing more than Rs. 20 crores with a total cost of Rs. 94500 crores. About two-thirds of these projects which were under implementation were facing time and cost overrun. In Kerala, a number of works got delayed due to various reasons. Many works in the Kerala

Public Works Department can be cited as examples for the delay. Such overruns not only erode financial outlay on development projects but also thwart progress in industrial and infrastructural development. With a number of projects running out of schedule, one cannot hope for accelerated development in a country. Several developing countries face a similar situation.

Implementation of development programmes involve construction activities in several areas such as roads, buildings, dams, canal systems, power house, transmission lines, stadiums, industries and so on. Management of the activities involved in every one of these areas, right from the conceptual stage to ultimate construction, has different and distinct features in each case. Timely implementation of projects is important to avoid cost over run. The present day constructions of projects are mostly complex, both technically and commercially. Therefore it is necessary that the construction manager should have the right skill both technical and managerial, innovative approach, foresight and awareness of national and international markets. Appropriate cost effective and innovative technologies of construction and high level of project management backed by dynamic management information system and logistics are of paramount importance in achieving economy and speedy execution. It is necessary not only to devise and detail the projects with foresight and precision so as to obviate any deficiency, but also to ensure harmonious involvement and participation of all concerned in this giant exercise.

**Areas of weakness:** - The following are the possible areas of weakness in the present day project implementation systems which result in time and cost overrun:

- (i) Project planning
- (ii) Estimating project cost
- (iii) Contracting, vendor analysis and rating
- (iv) Monitoring
- (v) In house consultancy

This serious economic problem can be solved only by serious efforts on the part of project owners and implementing authorities to understand the causes and roots of the problem and a commitment to avoid them.

Fortunately, there are instances in Kerala that certain major projects have been completed recently without time and cost over runs. In this context a critical study on those major construction projects vis-à-vis effectiveness in project implementation is felt relevant. In the study an attempt has been made to bring out important aspects of construction management and to outline some strategic action points for speedy implementation of projects after analysing various factors affecting the project implementation process. So the present study is likely to be of immense value for the ongoing as well as the future major projects. It has, however, been attempted to keep the generality of the study so that the results and the methodology could be applied to other development projects also.

### **1.3 AREA OF INVESTIGATION**

By and large, the construction industry in Kerala suffers from ineffective project management. Project over run can be seen in many of the projects undertaken by the state Government, before 1990. Certain badly delayed projects in Kerala are Kallada Irrigation Project, Kanjirappuzha Project, Chimmini Dam Project, Kakkad Project etc. There are time and cost overruns which range between 4 to 6 times from the original estimates.

But recently the trend has changed. Three major projects in Kerala have been completed successfully on schedule. Those three projects undertaken by the Government of Kerala/Supported organizations have been selected for the case study. They are projects of Legislative Complex undertaken by the Government through Kerala PWD, International Stadium promoted by the Greater Cochin Development Authority and the International Airport promoted by Cochin International Airport Ltd. Greater Cochin Development Authority and the Cochin International airport Ltd. are government supported organizations. These three major projects have been selected for the case study because these are the three mega projects which draw the public attraction in a big way. Eventhough the Legislative Complex Project had been started in the year 1986, the chunk of the work has been completed during the two years 1996-98. The construction of the 70 crore International Stadium was completed within 515 days against targeted days of 365. The multicrore International Air port at

Nedumbassery has been completed very recently. In the present study an attempt has been made to bring out the construction management aspects and to suggest certain action points for speedy implementation. The results obtained from the study can be made use of for taking corrective actions in future projects.

#### **1.4 OBJECTIVES OF THE STUDY**

Aims and objectives of the present study may be listed as follows:

- (i) To bring out the construction management aspects which led for the successful completion of the project.
- (ii) To analyse various factors affecting the project implementation
- (iii) To know the modern management techniques that have been used in the projects and the techniques adopted.
- (iv) To outline the major factors responsible for time and cost over runs.
- (v) To outline some action points for speedy implementation of the projects
- (vi) To analyse the leadership styles of the project leaders.
- (vii) To differentiate the various strategies adopted by the Project Leaders in the implementation of the projects.
- (viii) To analyse the monitoring mechanism of the projects.
- (ix) To give a detailed description of the projects since these three projects are user friendly.
- (x) To bring out the ingredients of effectiveness in project implementation.
- (xi) To formulate necessary equations and relations that can be followed in State PWD with a view to improve the efficiency and economy in performance.

#### **1.5 SCOPE OF THE WORK**

Case studies have been taken up to analyse for the following parameters, from the major projects undertaken by the government/government supported organisations.

- (a) Effective implementation of projects is mainly dependent on the Project Leaders.
- (b) Specific traits of the Project Leader
- (c) System of approach for better performance effectiveness



- (d) Successful methodologies tested by the Project Leaders
- (e) Various aspects of the style of the Project Leaders
- (f) The parameters which caused the delay in each project
- (g) Contributing factors which accelerated these three projects
- (h) Various aspects involved in construction management of a project
- (i) Role of different parties in the construction projects
- (j) Importance of monitoring mechanism in the successful execution of the project.
- (k) Project implementation can be performed effectively and efficiently only when there is a strong team and leadership
- (l) Key lessons learnt from the executed project.
- (m) In effective project implementation - causes and remedies.

## **1.6 ABSTRACT**

The work has been organised as shown below:

Chapter 1 presents a brief note on the state at which the construction industry stands at present, bringing into focus the significance of the critical study. Relevance of the study, area of investigation and objectives of the study are outlined in this chapter. The 2<sup>nd</sup> chapter presents a review of the literature on the relevant areas.

In the third chapter an analysis on time and cost overrun in construction highlighting the major factors responsible for it has been done. A couple of case studies to estimate loss to the nation on account of delay in construction have been presented in the chapter. The need for an appropriate estimate and a competent contractor has been emphasised for improving effectiveness in the project implementation. Certain useful equations and thoughts have been formulated on this area in this chapter that can be followed in State PWD and other Govt. organisations.

Case studies on project implementation of major projects undertaken by Government sponsored/supported organizations in Kerala have been dealt with in Chapter 4. A detailed description of the project of Kerala Legislature Complex with a critical analysis has been given in this chapter. A detailed account of the

investigations carried out on the construction of International Stadium, a sports project of Greater Cochin Development Authority is included here. The project details of Cochin International Airport at Nedumbassery, its promoters and contractors are also discussed in Chapter 4.

Various aspects of implementation which led the above projects successful have been discussed in chapter 5. The data collected were analysed through discussion and perceptions to arrive at certain conclusions. The emergence of front-loaded contract and its impact on economics of the project execution are dealt with in this chapter. Analysis of delays in respect of the various project narrated in chapter 3 has been done here. The root causes of the project time and overrun and its remedial measures are also enlisted in this chapter.

Study of cost and time overrun of any construction project is a part of construction management. Under the present environment of heavy investment on construction activities in India, the consequences of mismanagement many a time lead to excessive expenditure which are not be avoidable. Cost consciousness, therefore has to be keener than ever before. Optimization in investment can be achieved by improved dynamism in construction management. The successful completion of construction projects within the specified programme, optimizing three major attributes of the process - quality, schedule and costs - has become the most valuable and challenging task for the engineer - managers to perform. So, the various aspects of construction management such as cost control, schedule control, quality assurance, management techniques etc. have also been discussed in this fifth chapter.

Chapter 6 summarises the conclusions drawn from the above critical<sub>1</sub> of major construction projects in Kerala.

## CHAPTER - 2

### LITERATURE SURVEY

#### 2.1 INTRODUCTION

Engineering and management are professions dedicated to solving problems. Engineering enables creation of value out of seeming trash. Out of dirt emerge brick, cement, steel and semi conductors and from them form buildings, machines and computers through engineering. Management makes it possible to bring order out of apparent chaos. Resource wastes and people conflicts are transformed to profitable products and efficient organizations through management. Engineers, by and large, are not adequately oriented towards management skills. The Construction Management is essential in order to derive the required benefits from the new technological developments and for the effective implementation of the projects.

Efficient Construction Management is of great topical importance for our country because it enables optimal use of material and man power resources and quickest returns for the money invested. The various aspects involved in construction management of a project are (1) Management of project planning (2) Contract management (3) Productivity management (4) Construction site management including layout of project, storeyard etc. (5) Planning of safety management and strict observance of safety rules (6) Quality control management of projects (7) Conflicting interest management between different parties (8) Maintenance management during construction period etc. Factors which contribute to good construction management are thoroughness in design standards, able leadership and committed team, proper scheduling with the help of net work charts etc. While a lot of care is taken in the contract management, the same cannot be said of the importance of preparation of a realistic estimate, different parameters to be considered in the selection of a contractor, a good project management team and rationalisation of some conditions of the contract which are dependent on market variations and fluctuations. Leaving aside a few exceptions, the construction industry fluctuations presents an appalling picture,

particularly in government sector. Delays are rampant, cost over runs are common with deteriorating quality. This study concentrates mainly on these aspects.

## **2.2. CONSTRUCTION MANAGEMENT**

Construction Management is the process of professional management applied to the construction programme from project conception to completion for the purpose of controlling time, cost and quality. It is not a brand-new or revolutionary concept. In fact many of its methods are already applied by industry professionals everywhere. But, there is one overriding feature which makes CM so effective: it takes established construction practices, current technological advances and the latest management methods - and welds them into an efficient, smoothly working system. The term 'Construction Management' has been used to describe a variety of activities ranging from general contracting to the application of Critical Path Method (CPM) Scheduling. To meet the needs of the times, the construction industry has come up with a new marriage contract for owners, contractors and designers: it is called Construction Management or CM. In keeping with the wedding whimsy, CM brought to the industry "something old, something new, something borrowed". Everyone involved with CM agrees that it is not a totally new concept, yet it is not just more of the same old thing. The "something borrowed" applies to a number of new techniques that have evolved, including network analysis, fast tracking, cost studies, the design-build approach and turn-key organization. Kavanagh et. al (1980) emphasized time, cost and quality- the elements that can be controlled by a construction manager.

Construction is a highly competitive field where many have entered impetuously without realising the inherent complexity of the managerial skills required, and have consequently failed. To be successful in this field either as a business man or as an executive, one must know fairly well all aspects of business management with their nuances relevant to the construction industry. It is those nuances peculiar to the special features of construction operations which make construction management different from other branches of management practice. The importance of construction management is being realised in India (Joy, 1990).

According to Ahuja (1980), when design is the responsibility of an architect/engineer and only construction work is assigned to professional management, it is a construction management contract. Although the design is not supervised by the construction manager, he provides his input with respect to its constructability. Most of the advantages and disadvantages of project management are applicable in the case of construction management as well. Project management attempts to meet the objectives of design and construction of a facility within the time and cost limitations, using the required resources in the most efficient manner. Project management methods are usually adopted when either large complex projects involving many disciplines in engineering and related fields are contemplated or when the owner desires completion sooner than could be achieved by the traditional process of awaiting design completion before commencing construction.

In construction management type contracts, one firm is retained to coordinate all activities from concept design through acceptance the facility. The firm represents the owner in all construction management activities. In this type of contract, construction management is defined as that group of management activities related to a construction program, carried out during the pre-design, design, and construction phases, that contributes to the control of time and cost in the construction of a new facility (Halpin and Woodhead, 1982).

(Tenah and Guevara, 1985) reported that the recently formed organization of construction management firms, Construction Management Association of America (CMAA), has a great potential for becoming the regulatory body for construction management practice in the country. This may build up construction management services into a formidable professional services, as well as resolve some of the ambiguities presently plaguing the system. It is likely that the CMAA will be successful in establishing itself a legitimate body and that eventually most states will follow the paths of Indiana and South Carolina. With this growth will probably come the control of licensing by the individual state boards.

The normal practice of ordinary construction by small/medium contractors, government departments/corporations is cast-in-situ work in the field. The level of

supervision at the site has gone down considerably due to multifarious factors such as indiscipline, unaccountability, deteriorating work-culture. Despite the increase in staff strength, the supervision in the field has not improved. Due to multiplicity of works, it also becomes necessary to stream line the system of construction management which is not possible for government departments/corporations to adopt quickly. The bureaucratic channels are the impediments. The only solution, according to Sodhi (1993) lies in to introduce the concept of consultants for construction management as in U.S.A. and other western countries.

The system has also been started in India and is becoming popular. Housing and Urban Development Corporation (HUDCO) is also adopting the same in some of its projects in Delhi. At certain normal insignificant charges, the responsibility of managing the projects, is given to consultants on definite terms and conditions and government departments enforce these conditions, thus ensuring proper supervision and construction management.

### **2.3. COST AND TIME OVER RUNS IN PROJECTS**

A critical analysis of the major civil engineering projects taken up for execution during the last five decades has indicated that there has been considerable cost and time over runs in most of the projects. The costs of the projects increase by several times and accrual of benefits gets delayed, resulting in further financial losses and retarding the overall economic growth in the country. This becomes a major cause of concern and upsets the process of Planning. The importance of detailed and exhaustive investigations and planning, scientific construction management, adoption of modern techniques in construction of intricate and difficult projects, close and effective monitoring of the project activities during its implementation and post evaluation of projects is being realised by all and greater emphasis has to be laid on these in future to minimise these maladies. The phenomenon of project cost and time over run has presently attracted a widespread attention of project managers within the country. According to Joshi (1987) to assess the rationality of the increased cost of construction of civil works of various types, it becomes obligatory to arrive at a construction price index for roads, bridges and buildings etc. separately, since such an exercise has not

been done so far. He suggested that no project or its project costs should be approved without making provisions in the estimate against escalation due to reasons such as fiscal policy changes, short supply of materials etc. No provision of these items in the approved estimates apparently make the completion costs abnormally high.

A time over run in the project implementation leads to cost over run and loss to the nation. For our country, it is desirable to adopt appropriate technology with minimum borrowed technology and maximum utilization of local resources. The possible areas in which construction technology may be improved are: systems approach to project management, information technology, weather technology, space technology, robotics in construction etc. The present day policy of economic liberalisation may go a long way in inducting sophisticated and latest state-of-the-art technologies through collaborations and foreign investments. Our thinking and approach to any problem must be scientific (Panda 1996).

Vasavada (1994) stated that there are numerous cases wherein a contractor cannot complete the work within the specified time limit, because of the failure on the part of the owner to :

- (i) provide the site at the proper time;
- (ii) supply materials which the owner has agreed to supply as per contract in time,
- (iii) Supply the drawings when required by the contractor.

Apart from these delays, the scope of work may get altered due to extras and variations, the delay in completion would be taken as a happening due to the owner. For all such delays, contractor cannot be held responsible and is relieved from the liability to pay liquidated damages for delay.

The optimized completion time of a project is not a simple phenomenon. To arrive at this time the project net work graph has to be drawn. Complete net work analysis has to be done and critical path for the network analysis determined (Joshi 1988) From the utility data giving time and crash cost of the critical and near-critical activities of the project the time-cost trade-off are to be determined. Direct cost curve,

indirect cost curve and then the total cost curve are to be plotted. The total cost curves will be able to give the optimized completion time of the project for some optimum cost of it.

## **2.4 RELEVANCE OF TECHNOLOGY ADOPTION**

In many developing countries, efforts are made to adopt technologies of different levels to suit domestic conditions. Providing housing at affordable cost to the teeming millions in the country remains as challenging a task as ever despite commendable advancement in the field of Cost Effective construction technology in the country. By the use of traditional materials and construction methods alone, it will not be possible to construct houses and other buildings at a pace to match with the ever increasing demand. Adoption of newly developed materials and faster construction techniques developed by various research organisations along with the use of traditional materials and construction techniques will be necessary to solve the problem of housing and other buildings in the country. Engineers and builders have a great role to play in popularising cost effective technology.

According to Manjumdar (1997) planning in developing country like India, is meaningless unless it is possible through technological studies and research, to reduce the existing levels of cost and to optimise the use of resources. Savings, if any achieved, would help to ease the pressure of the total investment in the economy. Influenced by the Laurie Baker technique a 123.1m<sup>2</sup> building (named supervisor site office) has been constructed at Calcutta Electric Supply Corporation Ltd's newly constructed Thermal Power Stations, at Budge. The building is made by using conventional method, but certain innovative measures have been adopted on the RCC roof which has been constructed with earthen tiled RCC filler slab, resulting in substantial saving of cost. Based on the study of completed housing projects in Cochin region, Salam, and Jose (1995) found that the average weightage for selected building materials is 72.94% and for labour is 27.06%. The importance of controlling the use of scarce materials has been emphasised. The goal of national housing policy should be low-cost construction for all, not merely for 'the poor'. The low-cost housing techniques should minimise the use of scarce materials, especially cement, steel and timber, and



promote the use of materials available locally as well as materials which can be manufactured by small scale industry. There have been tremendous developments in respect of civil engineering projects all over the world. Such developments include new technologies, both in the conception as well as in the realization of structures. The size of projects has also been steadily becoming larger and larger. Adoption of new materials such as special types of cement and improved quality steel, computer-aided design in the design of multistoreyed buildings, and use of modern management techniques in the implementation of projects are some of the modern trends in civil engineering practice.

## **2.5 AN APPROACH TOWARDS EFFECTIVE PROJECT MANAGEMENT**

Good project management should aim at completion of project within time and cost projections and ensuring the required quality parameters. Implementation phase of a project takes up 85% of project time and in this, ability of the project manager plays a vital role. Management qualities are vitally related to credibility, integrity, clarity of goal and daring attitude. Proper scheduling by Critical Path Method and monitoring of progress are imperative for the success in the implementation of a project. The success of a project depends greatly on the follow up action and meticulous planning and coordinating. The modern Philosophy of project implementation is a 'partnership approach' between client, contractor and consultant, working closely as a team for accomplishment of a common objective (Panda 1992).

It is essential that the contractor/ sub contractors chosen shall be reliable, result-oriented and the team must develop mutual trust amongst each other. It is also necessary that the project team consisting of client, consulting engineers and supplier/contractors should be committed, dedicated and sincere in their efforts and strive for professional excellence. Basically, there are two principal approaches for project implementation-turnkey and non-turnkey approaches. In the turnkey approach, the whole work for implementation of the project including detailed engineering, supply of plant and equipment, construction and erection work at site upto commissioning is entrusted to one agency. The turnkey approach can be further categorised as turnkey as applied to the total project and semi-turnkey project in which

each individual plant unit is executed on turnkey basis. The owner either utilises their in house expertise or consultants for conceptual design, preparation of broad specifications and defining the scope of work. For non-turnkey projects, a number of contracts are awarded for various items of work or executed departmentally.

Nagabhushana Rau (1992) observed that most of the projects are delayed; costs go up, quality assurances lacking and problems arise during execution. This matter has received enough attention of the various departments and a number of committees have gone into the details. A working group of the Planning Commission also went into the details and recommendations on the study of the existing practice and problems on projects. The owners and the Government who start these projects have to manage projects well from initial stages.

Monitoring in its technical and real application to the field projects may be broadly and practically defined as to monitor (to keep an open eye with activeness, having proper check, motivation, control and improvement strategies in mind) an objective and its progress, in space and time, to keep up the desired discipline of a system with respect to various factors such as social, physical, financial, political, technical, organizational and/or administrative within the frame work of an environment (Jain 1993). The monitoring and evaluation functions are related but distinct. Monitoring means gathering data, obtaining information during the implementation of a project and using that information to (a) enable the project administration to assess progress of implementation of objectives, and (b) take timely due decisions and corrective actions to ensure that (i) progress and discipline is maintained according to a predetermined estimated schedule and (ii) completion is achieved within given resources, cost and time limits. It is largely an internal project activity though corrective action may also demand higher level decisions. Evaluation, on the other hand, assess the overall project effects and their impact. Evaluation and monitoring, both, thus are extremely valuable and effective tools for (a) improving plan formulation and implementation, (b) minimising and, if possible, eliminating time and cost over runs. To have an efficient and objective monitoring system, in addition to manual monitoring, it may be necessary also to introduce computerized monitoring and management information system.

## 2.6 FLUCTUATION CLAUSES

These clauses are variously designed to obtain for the contractor the amount of any increase in his costs, usually of labour or materials or both, which may take place after his tender and before the work is completed. Such provisions come under “variation of price”, which are generally incorporated in building and engineering contracts.

In the case of labour, it is not generally difficult to determine without precision the amount of any such increase since wage rates are controlled by official statutory bodies within the industry and come into operation of fixed rates. In this case difficulties of interpretation are only likely to arise where there is doubt as to the exact payments likely to be covered by the clauses.

A fluctuation clause in a contract provided that the contractor would be entitled to be paid increase in cost due to increase in “rates of wages payable for any labour”. It was held by the House of Lords that these words are not wide enough to include any increase in the cost of stamps purchased by the employer for the credit of his work men under the “ holidays with pay” scheme for the engineering industry.

In relation to materials it is extremely difficult to draft any fluctuation clause which can operate both fairly and precisely partly because of the great difficulty, particularly with many of the more elementary building materials, of these materials is at the date of tender against which to compare later actual cost. Further more, on many large contracts, contractors may make their own arrangements outside in any available market for the supply of materials such as sand, hardcore and gravel and may even have their own quarries or deposits for winning them. Even where this is not so, the concept of market offer doesn't really apply, and it is impossible to obtain a realistic price for materials unless the location of the site, quantities needed and time for delivery are known. The method adopted by most contracts is to use the concept of a market price prevailing at the time of tender, but to attempt to avoid the difficulties referred to by providing for the insertion of all materials in respecter of which the contractor intends to claim under the fluctuation clause in a list or schedule forming

part of the contract documents and usually known as a basic price list, together with the alleged market price of the material at the date of tender. In the employer's interest it is essential that the prices of such a list should be most carefully checked and agreed before the contract is signed, since, if the prices are too low the employer will be compelled to make substantial additional payments. The task of architect or surveyor in checking these prices is an unenviable one, since, in many cases no reliable quotation can be obtained by tendering contractor not yet in a position to give firm order. Suppliers often supply quotations freely for token quantities at optimistic prices during the tender stage but later when a firm order is asked for, quote substantially higher prices. There is also little doubt that the system amounts to an invitation to suppliers to raise their prices since, once armed with fluctuations clause, the contractor has no interest or incentive to resist the imposition of higher prices by suppliers.

Wallace (1970) reported that variation of price clause may mean a clause enabling the work and consequently the contract sum, to be varied or a fluctuation clause enabling the contract sum to be adjusted for rises or falls in the cost of labour or materials. These clauses are variously designed to obtain for the contractor the amount of any increase in his costs, usually of labour or materials or both, which may take place after his tender and before the work is completed.

The method adopted by most contracts is to use the concept of a market price prevailing at the time of tender, and to attempt to avoid the difficulties referred to by providing for the insertion of all materials in respect of which the contractor intends to claim under the fluctuation clause in a list forming part of the contract documents, usually known as a "basic price list" together with the alleged market price of the material at the date of tender. In the employer's interest it is essential that the prices in such a list should be most carefully checked and agreed before the contract is signed, since if the prices are too low, the employer will be compelled to make substantial additional payments.

**2.6.1 THE TENDER CONDITION NO. 28 - CMDS states that G.C.D.A. will permit an ESCALATION clause in the contract according to the following formulas for the works done during every quarter.**

Escalation value on the work remaining to be executed shall be payable to the contractor from the time the Average all India whole-sale price index for all commodities for the period under reckoning as published in the R.B.I. bulletin increases by more than 15% of what is on the date of agreement comes into force. The amount of escalation shall be payable only on the value of materials and labour supplied by the contractor and proportional to the increase in indices during the period of reckoning. Value of materials shall be 60% of the total value of the work inclusive of the cost of departmental materials supplied. Value of labour shall be 25% of the total value of the work.

Escalation amount on account of increase in cost of materials and labour shall be calculated on the basis of the formula given below:-

$$VM = \left( \frac{60}{100}(VX) - (C + S) \right) \times \frac{WI - WIO}{WIO} \quad (2.6.1.1)$$

Where VM = variation in materials cost ie., increase or decrease in the amount in Rupees to be paid or recovered.

VX = Value of work done including advances on materials procured and brought on site for incorporating in work during the period under reckoning.

C = Cost of cement } Covered by clause 55 of the notice Inviting tenders.  
S = cost of steel }

WI = Average all India wholesale price index for all commodities for the period under reckoning as published in the RBI Bulletin.

WIO = All India wholesale price index for all commodities on the date the Agreement comes into force.

Labour.

$$VL = \frac{25}{100} \times (V) \frac{(I-10)}{(10)} \quad (2.6.1.2)$$

Where VL = Variation in labour cost increase or decrease in the amount in rupees to be paid or recovered.

V = Value of work done excluding the advance on materials brought on site for incorporating in the work during the period under reckoning.

I = Average consumer price Index number for working class for Cochin declared by Statistical Bureau, Ernakulam for the period under reckoning.

IO = Consumer price index number for working class for Cochin declared by Statistical Bureau, Ernakulam on the date the Agreement comes into force.

No escalation shall be permitted for the work done after the date of completion originally fixed in the agreement. Even if the time of completion is extended under any circumstances the contractor is not entitled to get any escalation for the quantity of work to be done after the expiry of the original time of completion, as time being the essence of the contract. No other escalation whether due to statutory reason or for any other reason will be admitted.

## **2.6.2 THE CONTRACT CLAUSE OF CPWD**

CLAUSE 10(cc) If the price of materials (not being materials supplied or services rendered at fixed prices by the department in accordance with clauses 10& 34 hereof) and/or wages of labour required for execution of the work increase, the contractor shall be compensated for such increase as per provisions detailed below and the amount of the contract shall accordingly be varied, subject to the condition that such compensation for escalation in prices shall be available only for the work done during the stipulated period of the contract including such period for which the contract is validly extended under the provisions of clause 5 of the contract without any action under clause 2 and also subject to the condition that no such compensation shall

be payable for a work for which the stipulated period of completion is 6 months or less. Such compensation for escalation in the prices of materials and labour, when due, shall be worked out based on the following provisions:

- 1) The base date for working out such escalation shall be the last date on which tenders were stipulated to be received.
- 2) The cost of work on which escalation will be payable shall be reckoned as 85% of the cost of work as per the bills, running or final, and from this amount the value of materials supplied under clause 10, of this contract or services rendered at fixed charges as per clause 34 of this contract, and proposed to be recovered in the particular bill, shall be deducted before the amount of compensation for escalation is worked out. In the case of materials brought to site for which any secured advance is included in the bill, the full value of such materials as assessed by the Engineer-in-Charge (and not the reduced amount for which secured advance has been paid) shall be included in the cost of work done for operation of this clause. Similarly, when such materials are incorporated in the work and the secured advance is deducted from the cost of bill, the full assessed value of the materials originally considered for operation of this clause should be deducted from the cost of the work shown the bill, running or final. Further the cost of the work shall not include any work for which payment is made under clause 12 or 12 (a) at prevailing market rates.
- 3) The components of materials, labour P.O.L.etc., shall be predetermined for every work and incorporated in the conditions of contract attached to the tender papers and the decision of the Engineer-in-Charge in working out such percentages shall be binding on the contractor.
- 4) The compensation for escalation for materials and P.O.L shall be worked out as per the formula given below

(i)  $VM = W \times (X/100) \times (M1 - M10) / M10$  (2.6.2.1)

VM = Variation in material cost i.e. increase or decrease in the amount in Rupees to be paid or recovered.

W = Cost of work done worked out as indicated in sub para 2 above.

X = Component of materials expressed as percent of the total value of work.

M1 & M10- All India whole sale index all commodities for the period under reckoning as published by the Economic Adviser to Govt. of India, Ministry of Industry & commerce, for the period under consideration & that valid at the time of receipt of receipt of tenders, respectively.

(ii)  $VF = W \times Z / 100 \times (F1 - Fio) / Fio$  (2.6.2.2)

VF= Amount to be paid or recovered in respect of variation in P.O.L component

W = Value of work done, worked out as indicated in sub para 2 above

Z = Component of P.O.L expressed as percent of total value of work as indicated under the special conditions of contract.

F1 & Fio = Average index number of wholesale price for group (fuel, powerlight and lubricants) as published weekly by the Economic Adviser to Govt. of India Ministry of Industry and Commerce for the period under reckoning and the valid at the time of receipt of tenders, respectively.

5. The following principles shall be followed while working out the indices mentioned in para 4 above:

(a) The compensation for escalation shall be worked out at quarterly intervals and shall be with respect to the cost of work done during the three calendar months of the said quarter. The first such payment shall be made at the end three months after the month (excluding) in which the tender was accepted and thereafter at three months interval. At the time of completion of the work, the last period for payment might become less than 3 months, depending on the actual date of completion.

(b) The index (MI/FI etc.) relevant to any quarter for which such compensation is paid shall be the arithmetical average of the indices relevant to the three calendar months. If the period upto date of completion after the quarter covered by the last such instalment of payment, is less than three months,



the index MI & FI shall be the average of the indices for the months falling within that period.

(c) The base index, Mio Fio etc. shall be the one relating to the month in which the tender was stipulated to be received.

6) The compensation for escalation for labour shall be worked out as per the formula given below:

$$(1) VL = W \times (Y/100) \times (LI-Lio) / Lio \quad (2.6.2.3)$$

VL = Variation in labour cost i.e. increase or decrease in the amount in rupees to be paid or recovered.

W = Value of work done, worked out as indicated in sub para 2 above.

Y = Component of labour expressed as a percentage of the total value of the work.

L10 = Minimum daily wage in Rupees of an unskilled adult male mazdoor, as fixed under any law, statutory rule or order as on the last date on which tenders for the work were to be received.

L1 = Minimum wage in Rupees of an unskilled adult male mazdoor, as fixed under any law, statutory rule or order as applicable on the last day of the quarter previous to the one during which the escalation is being paid.

7) Following principles will be followed while working out the compensation as per sub para 6 above.

a) The minimum wage of an unskilled male mazdoor mentioned in sub para 6 above shall be the higher of the following two figures; namely those notified by Government of India, Ministry of Labour and the those notified by the local administration, both relevant to the place of work and the period of reckoning.

b) The escalation for labour also shall be paid at the same quarterly intervals when escalation due to increase in cost of materials and/ or P.O.L. is paid under this clause. If such revision the escalation compensation shall be payable for work

done in all quarters subsequent to the quarter in which the revision of minimum wages takes place.

- c) Irrespective of variations in minimum wages of any category of labour, for the purpose of this clause, the variation in the rates for an unskilled adult male mazdoor alone shall form the basis for working out the escalation compensation payable on the labour component.

8) In the event the price of materials and/or wages of labour required for execution of the work decrease/s there shall be downward adjustment of the cost of works so that such price of materials and/or wages of labour shall be deductible from cost of work under this contract and in this regard the formula here in before stated under this clause 10 (cc) shall mutatis mutandis apply, provided that:

- i) No such adjustment for the decrease in the price of materials and/or wages of labour aforementioned would be made in case of contracts in which stipulated period of completion of the work is six months or less;
- ii) The Engineer-in-Charge shall other wise be entitled to lay down the principles on which the provision of this sub clause shall be implemented from time to time and the decision of the Engineer-in-Charge in this behalf shall be final and binding.

Provided always that the provision of the preceding clause 10© shall not be applicable for contracts where provisions of this clause are applicable but in case where provisions of this clause are not applicable, the provision of clause 10© will become applicable.

### **2.6.3 THE TENDER CONDITION NO.32-A OF N.V.D.A.(M.P):**

#### **Price Adjustment**

The amount paid to the contractor for the work done shall be adjusted for increase or decrease in the rates of labour, material and P.O.L excepting those materials

supplied by Government as per schedule, quarterly. For this purpose, quarters would be January to March, April to June, July to September and October to December, and the month/date of opening of tenders means the month/date prescribed in the N.I.T. for opening the tender.

#### A. Labour

Increase or decrease in the cost due to labour shall be calculated quarterly in accordance with following formula:

$$VI = 0.75 \times \frac{PI}{100} \times R \times \frac{(L - L_0)}{L_0} \quad (2.6.3.1)$$

Where,

VI = Increase or decrease in the cost of works due to labour during the quarter.

R = The value of work done in Rupees during the quarter, less the value of materials supplied by the Government at fixed rates.

L<sub>0</sub> = The average consumer price index for industrial workers as applicable at INDORE (MP) for the month in which tenders were opened.

L = The average consumer price index for industrial workers as applicable at INDORE (MP) for the quarter under consideration.

PI = Percentage of labour component which shall be 48.

Note Consumer price index numbers for industrial workers as published by the Government of India, Ministry of Labour, Labour Bureau, Shimla, shall be the basis for calculation.

#### B. Materials (other than P.O.L)

The increase or decrease in cost of materials other than those supplied by Government at fixed rate shall be calculated quarterly in accordance with the following formula:

$$VM = 0.75 \times \frac{P_m}{100} \times R \times \frac{(M - M_o)}{M_o} \quad (2.6.3.2)$$

Where,

- VM = Increase or decrease in the cost of works due to such materials during the quarter.
- R = Value of work done in Rupees during the quarter, less the value of materials supplied by the Government at fixed rates.
- M<sub>o</sub> = The index number of whole sale prices in India for the month in which tenders were opened.
- M = the average index number of whole sale prices in India (all commodities) for the quarter under consideration.
- P<sub>m</sub> = Percentage of such material component which shall be 38.
- Note** The index numbers of whole sale prices in India (all commodities) shall be as published by the Government of India, Ministry of Industry, Office of the Economics, Advisor.

#### C. P.O.L

The increase or decrease in the cost of P.O.L. shall be calculated quarterly in accordance with the following formula:

$$V_p = 0.75 \times \frac{P_p}{100} \times R \times \frac{(P - P_o)}{P_o} \quad (2.6.3.3)$$

Where

- V<sub>p</sub> = Increase or decrease in the cost of works due to P.O.L. during the quarter under consideration.
- R = The value of work done in Rupees during the quarter, less the value of materials supplied by the Government at fixed rates.
- P<sub>o</sub> = The price of H.S.D oil at KHANDWA (MP) on the date on which tenders were opened.

- P = The average price of H.S.D oil at KHANDWA (MP) during the quarter under consideration.
- P<sub>p</sub> = Percentage of P.O.L. component shall be 14.

The price adjustment clause shall be applicable only for the work that is carried out within the stipulated time or extension thereof due to reasons as are not attributable to the contractor.

While working out the value of work done during a quarter, the value of the materials on which secured advance has been granted during the quarter should be added and the value of the materials for which such secured advance has been recovered during the quarter should be deducted.

The total of PI, P<sub>m</sub> and P<sub>p</sub> should be equal to 100.

No claims for price adjustment other than those provided herein shall be entertained.

#### **2.6.4 TENDER CONDITION OF T.N.E.B. (CHENNAI), CLAUSE 2.2 & 2.3**

##### **PRICE VARIATION:**

(QUOTE)

The rates quoted by you and accepted herein shall be as indicated in the Schedules enclosed to this acceptance letter. The rates accepted herein are subject to escalation for increase or decrease in the rates of Labour and Materials (other than those to be supplied by Board) during the scheduled contract period and authorised extensions thereof (if the causes for delay are not attributable to you and subject to grant of extension of time by Tamil Nadu Electricity Board) as per the following Price Variation formulae indicated in your supplementary technical bid.

##### **LABOUR**

$$V = 22\% \times R \times \frac{(I - I_0)}{I_0} \quad (2.6.4.1)$$

V = Amount of variation payable to/recoverable from the contractor during the quarter under review.

- R = Total value of work done during the quarter under review.
- Io = Average consumer price index number for Industrial workers in Tamil Nadu - Coimbatore Centre (General Index) for the quarter in which the tender has been submitted:- for July '90 (i.e. for 3<sup>rd</sup> quarter of 1990.)
- I = Average consumer price index number for industrial workers in Tamil Nadu - Coimbatore Centre (General Index) for the quarter under review (i.e.) the quarter relating to execution of work.

Price Indices to be used for the above computations shall be those published in Indian Labour Journal, Labour Bureau, Ministry of Labour, Government of India (Base 1982 = 100.)

### P.O.L

Increase or decrease in the payment due to P.O.L. to the contractor shall be computed for each quarter on the basis of the following formula.

$$VF = 18\% \times R \times \frac{(F - F_0)}{F_0} \quad (2.6.4.2)$$

Where

- VF = Amount of variation payable to /recoverable from the contractor during quarter under review.
- R = Total value of work done during the quarter under review.
- Of = The list price of high speed diesel oil of Indian Oil Corporation at Coimbatore on the closing date of submission of original bid (i.e.) 18-7-1990.
- F = The list price of high speed diesel oil of Indian Oil Corporation at Coimbatore during the quarter under review. (i.e.) the quarter relating to execution of work.

The base price of High Speed Diesel Oil which will be treated as representative of all P.O.L. items shall be as per list prices of Indian Oil Corporation at Coimbatore.

The list price of H.S.D. Oil of Indian Oil Corporation at Coimbatore on 18-7-1990 may be furnished by you with authenticated proof.

### ALL OTHER MATERIALS

If during the currency of the contract, there is an increase or decrease in the cost of material as reflected by the Index Number of wholesale price in India, All Commodities (new series base 1981-82 = 100), a corresponding increase or decrease in the payment to the contractor shall be computed for each quarter on the basis of the following formula.

$$V_m = 20\% \times R \times \frac{(M - M_o)}{M_o} \quad (2.64.3)$$

Where

- $V_m$  = Amount of variation payable to recoverable from the contractor during the quarter under review.
- $R$  = Total value of work done during the quarter under review.
- $M_o$  = Average Index Number of whole sale prices in India (New series base 1981-82 = 100). All commodities for the quarter in which tender had been submitted - for July '90. (i.e. 3<sup>rd</sup> quarter of 1990.)
- $M$  = Average Index Number of whole sale prices in India (new series base 1981-82 = 100). All commodities, for the quarter under review, (i.e.) the quarter relating to execution of work.

Index numbers are to be taken from the Indian Labour Journal published by the Labour Bureau, Govt. of India.

### MAXIMUM CEILING FOR ESCALATION

The maximum ceiling due to escalation payable will be 20% on contract value or any modified value after approval of Competent Authority less cost of material issued by the Board. The maximum ceiling or escalation payable to the contractor on each component will be as follows: -

Labour	6%
P.O.L.	7%
Materials	<u>7%</u>
Total	<u>20%</u>

The above maximum ceiling for escalation will be applied for intermediate bills also.

(UNQUOTE)

## 2.6.5 FLUCTUATION CLAUSES IN ADB PROJECT

### Clause 70.1 Increase or Decrease of Cost

Substitute the words 'following' in place of the words "Part II of these conditions" at the end of the Clause. Add the following below clause 70.1:

#### 70.1 (1) Price Adjustment

- (a) The amount payable to the contractor and valued at base rates and prices in the Interim Payment Certificate issue by the Engineer pursuant to clause 60.1 hereof shall be adjusted in respect of the rise or fall in the indexed costs of labour materials and other inputs to the works by the application of suitable price adjustments as determined by the formulae prescribed in this Clause.
- (b) To the extent that full compensation for any rise or fall in the costs to the Contractor is not covered by the provisions of this or other Clauses in the Contract, the unit rates and prices included in the Contract shall be deemed to include amounts to cover the contingency of such other rise or fall in costs.

#### 70.1 (2) Change in Cost

Variation of Price - Local Labour



D. The Contract Price will be subjected to adjustment on account of variation in cost of labour. The adjustment will be made according to the formula given below:-

$$V_1 = \frac{RI \times (C - C_0) \times L}{C_0} \quad (2.6.5.1)$$

Where

- (i) V1 = Variation in price on account of Local Labour during the period under consideration.
- (ii) C<sub>0</sub> = Base Cost Index related to the General Consumer Price Index for Industrial Worker on an All India Basis (Base 1960 = 10 or corresponding base Index) released by the Labour Bureau, Ministry of Labour, Government of India at the time specified in Clause 70.1 (2) (e) hereinafter.
- (iii) C = Current Cost Index related to the General Consumer Price Index for Industrial Workers on all-India basis during the period under consideration (Base 1960 = 100 or corresponding base Index) released by the above mentioned agency at the time specified in Clause 70. 1 (2) (e) hereinafter.
- (iv) L = A factor of 0.2 (zero point two) representing component of all local labour costs in the Contract Price including overheads, benefits amenities etc.
- (v) RI = Value of the Work done during the period under consideration and payable in non-convertible Indian Rupee Currency at the base rates and prices as applicable under the Contract.

Variation of Price - General

(a) The Contract Price will be subjected to adjustment on account of general variation of prices of all materials other than specifically provided in sub-clause 70.1 (4) hereinafter. The adjustment will be made according to the formula given below: -

$$V_2 = \frac{RI \times (I - I_0) \times G}{I_0} \quad (2.6.5.2)$$

Where

- (i) V2 = Variation in price on account of general variation of prices of all materials other than specifically provided in sub clause 70.1 (4) hereinafter.
- (ii) Io = Base Cost Index corresponding to the Wholesale Price in India (for all commodities) (Base 1970 - 1971 = 100 or corresponding base Index released by the Economic Adviser, Ministry of Industry, Government of India, at the time specified in Clause 70.1 (2) (e) hereinafter.
- (iii) I = Current Cost Index corresponding to the Wholesale Price in India (for all commodities) for the period under consideration (Base 1970 - 1971 = 100 or corresponding base Index released by the same agency at the time specified in Clause 70.1 (2) (e) hereinafter.
- (iv) G = Factor of 0.15 (zero point one five) representing component of all materials other than specifically provided elsewhere in the Contract Price.
- (v) RI = Value of the work done during the period under consideration and payable in non-convertible Indian Rupee Currency, at the base rates and prices as applicable under the Contract.

Variation of Price - POL

- (c) The Contract Price will be subjected to adjustment on account of variation of prices of POL. The adjustment will be made according to the formula given below:-

$$V3 = \frac{RI \times (P - P_0) \times Q}{P_0} \quad (2.6.5.3)$$

Where

- (i) V3 = Variation in price on account of POL during the period under consideration
- (ii) Po = Base Price of HSD at the fuel depot nearest to the site of Works at the time specified in clause 70.1 (2) (e)

- (iii) P = Current Price of HSD for the period under consideration at the fuel depot nearest to the site of works at the time specified in Clause 70.1 (2) (e)
- (iv) Q = Factor of 0.05 (zero point zero five) representing the component of POL in the Contract Price.
- (v) RI = Value of the work done during the period under consideration and payable in non-convertible Indian Rupee Currency at the base rates and prices as applicable under the Contract.

Variation of Price - Foreign Inputs, if any

- (a) The Contract Price will be subject to adjustment on account of general variation in prices due to all foreign inputs, if any to be provided for the Contractor in accordance with the details furnished by him in Schedule 1 of the Contract in accordance with the formula given below:

$$V4 = \frac{RF \times (F - F_0) \times 0.85}{F_0} \quad (2.6.5.4)$$

Where

- V4 = Variation of price in Indian Rupee on account of foreign inputs, if any during the period under consideration from countries other than India.
- F<sub>0</sub> = The official base index as applicable to foreign inputs like cost of technical personnel constructional plant etc. on construction projects in the Contractor's country or failing which on appropriate proxy index reflecting the cost at periodic intervals of providing an appropriate mix of expatriate personnel imported constructional plant etc. as the case may be at the time specified in Clause 70.1 (2) (e) hereinafter. The relevant index to be applied for this purpose shall be indicated by the tenderer in the Appendix to the Tender.

- F = The official current index corresponding to  $F_0$  at the time specified in clause 70.1 (2) (e) herein after. The relevant index to be applied for this purpose shall be indicated by the tenderer the Appendix to the tender.
- RF = The value of work done in Rupee during the period under consideration which is worked out as percentage of the total value of work done during the period under consideration and payable in convertible Indian Rupee Currency at base rates and prices as applicable under the contract the percentage being as given in Schedule 1 of Section VIII Volume 3.

All official/proxy indices to be used in the prescribed Price Adjustment Formula in this connection shall be subject to approval by the Engineer. Indices shall be appropriate for their purpose and shall relate to the Contractor's proposed source of supply of inputs on the basis of which his contract Price and expected foreign currency requirements shall have to be computed. As the proposed basis for price adjustment the Contractor shall have submitted along with his tender official publications showing the values of the proposed indices as available during the 12 months preceding the closing date for submission of tenders. The indices shall be well established and nationally recognised in the country of manufacture or origin. Preferably only Government Indices shall be used. The tenderer shall furnish authenticated copies of the relevant published Indices as and when requested by the Employer/Engineer.

#### Base - Current and Provisional Indices

(e) The base cost indices or prices shall be those ruling on the date 28 days prior to the closing date for the submission of tenders. Current indices or prices shall be those ruling on the date 28 (twenty eight) days prior to the last day of the period to which a particular Interim Payment Certificate is related. If at any time the current officially published or relevant proxy indices are not available provisional indices as determined by the Engineer will be used subject to subsequent correction of the amounts paid to the Contractor when the current indices become available.

## Price Adjustment

(f) The Price Adjustment shall be evaluated for the relevant date of each Interim Payment Certificate submitted by the Contractor pursuant to sub-clause 60.1 using the weighting prescribed in sub-clause 70.1 (2) hereof and the related current and base cost indices subject to any changes or corrections made in accordance with sub-clause 70.1 (2) of this Clause.

## The Adjustable Amount

(g) The adjustable amount of each Interim Payment Certificate shall be the difference between (I) the amount which in the opinion of the Engineer shall be due to the Contractor pursuant to sub-clause 60.1 (before deducting retentions) including the amount at base rates and prices of the scheduled work carried out and Day works (unless otherwise adjusted) but excluding the value of materials on site and (ii) the amount as calculated in (I) above and included in the last preceding Interim Payment Certificate issued by the Engineer. The adjustable amount shall exclude payments to nominated sub-contractors and any other amounts based upon actual cost or current prices.

## The Adjusted Amount

(h) The adjusted amount of each Payment Certificate shall be determined by applying the Price Adjustment to the adjustable amount and shall become payable to the Contractor in accordance with the provisions of Clause 60 subject to any deductions therefrom for retention money liquidated damages and any other monies due to the Employer from the Contractor including the recovery of advance mobilization loan, if any.

## Adjustment after Completion

(i) If the Contractor shall fail to complete the Works within the time for completion under Clause 43.1 adjustment of prices thereafter until the date of

completion of the works shall be made using either the indices or prices relating to the prescribed time for completion or the current indices or prices whichever is more favourable to the Employer provided that if an extension of time is granted pursuant to Clause 44.1 the above provision shall apply only to adjustments made after the expiry of such extension of time.

#### Changes in Source and Currency

70.1 (3) If the Contractor shall change the country or origin of the source of supply of any input to the works he shall immediately notify the Engineer who shall modify the price adjustment provisions subsequent to such change to reflect the relevant cost index from the actual country of origin of the input. If the currencies in which the contract price is expressed are different from the currencies of the sources of the relevant indices, the Engineer shall determine the correction to be applied in calculating the price Adjustment Factor in order to avoid distortions in the amount of price adjustment. Such correction shall be applied to the increment of price correspond to the ratio of the exchange rates between the respective currencies on the date of the base indices and the date of current indices as defined in sub-clause 70-1(2) hereof.

#### Increase or Decrease of Prices of Specified Materials

70.1(4) I) Increase or decrease of prices of specified materials will be adjusted by either an addition or a deduction from the contract Price. For the purpose of this sub-clause:-

"Specified materials" mean the materials stated in Schedule VII of section VIII of the tender documents and required on the site for the execution and completion of the permanent works.

"Basic Price" means the price for 'specified materials' indicated in Schedule VII of Section VIII of the Tender Documents.

ii) (a) Adjustments to the Contract price for bitumen

"Current Price" means the ex-refinery price for the bitumen from nearest refinery, Prevailing on the relevant date applicable for adjustment to the Contract price.

The adjustment to the contract Price under this sub-clause shall be calculated by applying the difference between the basic and Current Prices to the quantity of bitumen which is delivered to the site for use in the permanent works as per clause 60.2 hereof or is incorporated in permanent works whichever is earlier.

iii) (b) Adjustments to the Contract price for Cement & Steel

The contract Price will be subjected to adjustment on account of variations in cost of cement and steel which is delivered to the site for use in the permanent works as per clause 60.2 hereof or is incorporated in permanent works, whichever is earlier.

The formula given below:

$$V_c = \frac{S \times (M - M_c) \times T}{M_c} \quad (2.6.5.5)$$

Where  $V_c$  = Adjustment to the Contract Price on account of increase or decrease of cost indices of cement or steel, as applicable.

$S$  = Basic price for cement or steel, as applicable, and indicated in Schedule VII of the Section VIII of the tender document.

$M_c$  = Base cost index for cement/steel which shall be index for cement/iron and steel, as shown in the 'Index Numbers of Wholesale price in India-By Groups and sub-groups (Month end/year end date)' (Base 1981-82 =100), released by the office of Economic Adviser, Ministry of Industry, Government of India, prevailing on the date, 28 days prior to the closing date for submission of tenders.

$M$  = Current cost index for cement/steel which shall be the Index for cement/iron and steel as shown in the 'Index Numbers of Wholesale Prices in India-By groups and sub-groups (Month end/year end date)' (Base 1981-82 = 100) released by the office of the Economic Adviser,

Ministry of Industry, Government of India, relevant to the period in which cement/steel is delivered to the site for use in permanent works as per clause 60.2 hereof, or is incorporated in permanent works, whichever is earlier.

T = Quantity of cement or steel which is delivered to the site for use in the permanent works per Clause 60.2 hereof or is incorporated in permanent works, during the period for which the particular current cost index is applicable.

NOTE: The same cost index will apply to Mild Steel bars, high yield deformed bars, structural steel rolled sections and structural steel plates, as shown for "iron & steel" in the index numbers released by the office of the Economic Adviser, Ministry of Industry, Government of India.

- (iv) Any specified Materials removed from the site shall be clearly identified in the records required under paragraph (iv) of this Sub-Clause.
- (v) The Contractor shall at all times have regard to suitable markets and shall. Wherever buying materials a variation in the cost of which give rise to an adjustment of the Contract price under this Sub-Clause be diligent to buy or procure the same at the most economical prices as are consistent with the due performance by the Contractor of his obligations under the Contract.

If at any time there shall have been any lack of diligence default or negligence on the part of the Contractor, whether in observing the above requirement or otherwise, then for the purpose of adjusting the contract Price pursuant hereto no account shall be taken of any increase in cost which may be attributable to such lack of diligence default or negligence and the amount by which any cost would have been decreased but for such lack of diligence default or negligence shall be deducted from the contract Price.

- (vi) No other adjustment to the Contract Price on account of fluctuation in the cost of materials shall be made.



(vii) Overheads and Profits Excluded

In determining the amount of adjustment to the Contract Price pursuant to this Sub-Clause no account shall be taken of any overheads or profits.

(viii) Notice and Records

The contractor shall forthwith upon the happening of any event which may or may likely to give rise to adjustment of the Contract Price pursuant to this Sub-clause give notice thereof to the Engineer and the Contractor shall keep such books, accounts and other documents and records as are necessary to enable adjustment under this Sub-Clause to be made and shall at the request of the Engineer, furnish any invoices, accounts, documents or records so kept and such other information as the Engineer may require.

(ix) Adjustment after Date of Completion

Adjustment to the Contract Price after the due date for completion of the whole of the works pursuant to Clause 43 or after the date of completion of the whole of the Works certified pursuant to Clause 48 shall be made in accordance with current Rates or current Prices as applicable ruling at the due date for completion or the date stated in the Taking over Certificate whichever is earlier.

(x) Determination of Adjustment to Contract Price

The amount of any adjustment to the Contract Price pursuant to this Sub-Clause shall be determined by the Engineer in accordance with the foregoing rules.

Limit of Price Adjustment

70.1 (5) Provided that in determining all such price adjustments in accordance with the aforesaid sub clauses:

- (a) No account will be taken of any amount by which any cost incurred by the Contractor has been increased by default or negligence of the Contractor.
- (b) No increase in costs of specified materials mentioned in Clause 70.1 (4) above (whether or not it has been previously applied) shall apply after the expiry of the Contract Period or such extended time as may have been granted by the Engineer under the Conditions of Contract
- (c) On completion of the works and before final payment the Contractor shall give a certificate that he has made full and complete disclosure to the Engineer of every increase or decrease in price obtained by him on all items affected by this Clause.

#### Exemption from Price Adjustment

70.1 (6) The following items shall not be included in the price adjustment calculation:

- (a) Liquidated damages
- (b) Retention withheld and released
- (c) Advance payments in the form of loans and their repayments.
- (d) The value of any additional or varied work valued at current price.
- (e) Payment to "nominated" sub-contractors included as "provisional sums" or prime cost items in the general cost.

## **CHAPTER - 3**

# **TIME AND COST OVER RUN IN CONSTRUCTION: AN ANALYSIS**

### **3.1 INTRODUCTION**

Providing infrastructure facilities like roads, bridges, harbours, dams, water supply lines, power generation, industrial structures, stadiums, airports etc. to our country is the main business of construction. Every one is in a haste and time is the money. But we have not yet appreciated this very important aspect of construction time. It is talked at vehemently in almost all monitoring and progress review meetings. But the real stumbling-blocks are not identified for rectification. An attempt to analyse the factors responsible for time and cost overrun and consequent national loss will be a motive force to suggest ways for correction.

In each project, the reasons for the delay and cost over run may vary. An analysis on various projects undertaken by various agencies in national as well as in state level will bring out useful information that may be helpful in combating the impediments. The practice of awarding the work to a lowest tenderer without considering his past performance and expertise is not a healthy trend.

### **3.2 NATIONAL SCENARIO**

The Government of India's account of delays in its own projects (including construction component) is given in Table 3.1

**Table 3.1: Extent of Time & Cost in Projects with respect to latest Schedule**

Sector	No of Projects	Total Latest Approved	Cost Anticipated in Rs. Crores	Cost Over run	Project with cost over run				Proj. with time over run		
					No.	Latest approved	Anticipated	% increase	No.	Latest proved cost of these	Anti Ap cost of these
Atomic Energy	6	3108.7	3646.1	17.3	4	1716.4	2253.8	31.3	2	1061.2	1194.2
Civil Aviation	3	2415.0	2732.1	13.1	2	2197.1	2514.3	14.4	0	00	00
Coal	71	9918.4	12540.8	26.4	44	6184.7	8807.1	42.4	42	3962.4	5633.8
Fertilizer	7	1175.9	1917.1	63.0	7	1175.9	1917.1	63.0	7	1175.9	1917.1
Mines	3	3024.7	3156.8	4.4	3	3024.7	3156.8	4.4	1	2408.1	2476.9
Steel & Iron ore	11	13929.2	1543.3	10.8	10	13899.2	15400.3	10.8	7	13379.3	14604.3
Chem. & Petro. Chem	6	1693.9	1745.9	3.1	2	109.2	161.2	47.6	4	1569.9	1621.9
Petro & Natural Gas	27	6581.2	6453.0	1.9	5	1303.5	1564.9	20.1	21	5031.0	4891.9
Power	48	22474.2	28675.2	27.6	29	11186.9	17398.1	55.5	1	9378.8	14400.3
Paper cement and Auto	12	1593.2	1853.2	16.3	6	753.5	1013.6	34.5	6	808.4	942.9
Railways	89	6242.5	8669.5	38.9	53	4706.0	7197.1	52.9	16	1618.5	2498.7
Surface Transport	31	2893.7	3176.1	9.8	17	979.5	1262.0	28.8	19	2060.8	2334.9
Telecommunication	17	789.5	837.4	6.1	2	239.0	286.9	20.1	7	279.6	285.2
Total	331	75840.1	90833.5	19.8	184	474775.7	62933.1	32.6	163	42734.0	52802.1

Does not include the projects having negative cost over run, such as cambay as Basin Dev.

Drilling (Rs. 700.9 to 365.3 crores). Acquisition of Development Drilling (Rs. 90 to 55.2) etc

Courtesy: INDIAN MANAGEMENT - APRIL - MAY 1991

Effectiveness of our method and practices is clear from this. As on 1<sup>st</sup> January 1992, the total outlay of central sector project with individual allocation of more than Rs. 20 crores was Rs. 94500 crores. About two thirds of these projects which were under implementation had been facing time and cost over run. The power and the irrigation sectors are very badly affected. The annual report of Ministry Programme Implementation prior to finalisation of 9<sup>th</sup> Five Year Plan shows the following:-

- 119 projects (65% of the total projects) have suffered time over runs, which have gone as high as about 200%. The average delay in commissioning these projects was about 3 years.
- 125 projects (68% of the total projects) have suffered cost overruns, which have been as high as 75%.
- Projects for which no time and cost overruns have been indicated have mostly been taken up recently and it is likely that many of them will also suffer from time and cost over runs.

The under performance points towards the challenges involved. The normal projects in our country are expected to be completed within the time frame as given in table 3.2.

**Table 3.2: Time Frame for normal projects**

Projects	Time of construction desirable
Nuclear Plants	5 - 7 years
Thermal Power Plants	5 - 7 years
Dams	5 - 10 years
Housing in one city	10000 Nos/Year
Industrial production plants	1 - 2 years
Steel Plants	3 - 5 Years
Ports and Harbours	5 - 7 Years
Commercial Buildings: 4 Storeys	1 - 1.25 Years
20 Storeys	3 - 5 years

That is how estimates are made. The actual time taken for completion of such projects in India is assessed as 2 to 3 times the estimated time.

We have a very bad reputation in implementing construction projects in time. For example the first underground tube rail project in the country, the Metro railway in Calcutta had been delayed long enough. It took 20 years to complete the Rs. 1330 crore project. Hindustan Construction Company (HCC), the main civil engineering contractors for the project was fed up with the labour union. Due to the inordinate delay the Calcutta Metro Project cost four times more than the estimated costs.

The work on the Konkan Railway Project was stopped on March 26, 1993 following an order from the Central Government. It was restarted on November 3, 1993 after the Government accepted the recommendations of the Oza Committee. The seven month break in construction had led to a Rs. 100 crores cost overrun for the Konkan Railway Corporation. Konkan Railway is one of the most prestigious project, which was constructed under BOT concept, by forming a public sector company. It has connected Roha to Mangalore. Konkan Railway alignment passes through hilly terrain of western ghats.

Introduction of Rail Communication in India in the 1850's brought in its wake large scale tunneling. Engineers of the then G.I.P. Railway company constructed a large number of tunnels between Karjal - Lonawala & Kalyan Gatpuri sections on the South East and North East route respectively, across the Western Ghats in 1860 - 65. Lots of changes have taken place in the equipments, materials and techniques used for tunneling from the primitive hand held drills, gun powder and human labour. Fully automated mechanized drills, loaders, vehicles and slurry explosives have now become common place for rock tunneling. Tunnel boring machines are still rare in India. The total length of different tunnels in Konkan Railway Projects is 83 km. In Ratnagiri District alone the total length is worked out as 52 km. Out of this, the Karbude tunnel, which is located about 8 km from Ratnagiri along the rail route and 23 km by road route is the longest having a length of 6.5 km. Survey of equipment which could work in the small section of the tunnel revealed that an average monthly progress of 70 m per face could only be achieved. With two sets of imported tunneling equipment comprising of two electro-hydraulic drilling jumbo and two electro-hydraulic loader, an average monthly progress of 150 m per face was obtained.

Panval Nadi Viaduct in Ratnagiri (south) sector is the tallest bridge in the country. The total cost of this viaduct is 795.625 lakhs. Configuration of the viaduct, comprising of a continuous span pre-stressed concrete box girder (1x30 m +9 x 40m + 1x30 m) deck of 423.25 m long having falling gradient of 1 in 150 was constructed by adopting the technique of incremental launching for the first time in India.

In this Viaduct, the pier height is as high as 64 m and a normal configuration of simply supported girders would have resulted in a very heavy sub-structure. Such heavy sections further create problems of increase in seismic forces. Before finalising the span arrangements and the technique of construction, different technologies available and proved in India were considered. No doubt, the problems of Panval Nadi Viaduct needed an innovative solution and therefore, as a first step it was decided to adopt a continuous span pre-stressed concrete box girder. By adopting this configuration, tangible economy in the requirement of materials for the piers was obtained. Of course, part of the technology needed consultations with experts from abroad since such design had not been adopted in Asia till that time. The Incremental Launching Technique not only shall be very fast but will also bring the technology to the country. The bridge is designed by M/s. SPA Bombay and the contractors were M/s. L & T (ECC Construction group).

The estimated cost of the new road bridge across the Thane creek in Maharashtra was 41 crore. But due to the time overrun of one year for the completion, the construction cost was doubled.

55 Km Jammu - Udhampur Rail Line Project was started in 1982 at an estimated cost of Rs.50 crores. But when it was completed, the cost was increased to five times. Cost increases and Schedule slippages are general phenomena extending practically to all sectors such as power, coal, fertilizer, civil construction and manufacturing.

The slippages in the targets and Government's inability to pump in adequate funds for completion of irrigation projects have resulted in a big drain on the exchequer of Karnataka State due to the escalation of the cost of each project eight to

ten times the original estimates. The latest report of the Irrigation Department dealing extensively with performance budgeting relating to various projects gives an insight into the chronic slippage in the target and actual performance both in physical and financial terms. It is like the Government biting more than it can chew whether it is Upper Krishna Project or much older projects like the Tungabhadra, the Ghataprabha or the Malaprabha.

For instance, the cost of the Stage I of Upper Krishna Project was estimated to be Rs.283.65 crores (1976-77 rates). But due to inadequate flow of funds, the project proceeded at a snail's pace in the beginning. The project is now expected to beat the dead line of the year 2000 for utilising the State's share of Krishna waters. But the cost of Stage I has touched Rs.1071.10 crores as against the original estimate of Rs. 283.65 crores. The stage I covers construction of Alamatti Dam to a partial height, construction of the Narayanpur Left Bank Canal to irrigate 4.09 lakh hectares, construction of Alamatti Left Bank Canal including lifting arrangements to irrigate 20,235 hectares and construction of intake structures of foreshore lift irrigation scheme of Alamatti and Naranapur Reservoir. The report shows it will take a few more years before the full irrigation potential is developed. The Ghataprabha project, another major irrigation work in the Krishna Basin, is still to be completed in all respects. It was planned to complete the project in three stages. The stages I and II comprising of construction of Ghataprabha Left Bank Canal and construction of Hidkal Dam across the Ghataprabha near Hidkal village in Belgaum district to partial height, have been completed creating an irrigation potential of 1.40 lakh hectares. Mean while, the cost of stage III, estimated to be Rs.90.54 crores (at 1975-76 rates) which was technically cleared by the Planning commission, has gone up to Rs.800 crores at 1995-96 rates. The story of the Malaprabha project is not different. The project across the Malaprabha in the Krishna Basin near Manoli village in Belgaum district is designed to irrigate 2.20 lakhs hectares in Belgaum, Bijapur and Dharwad districts. The cost of the project was estimated to be about Rs.162 crores (at 1976-77 rates). But the revised estimate has boosted it to Rs.342 crores going by 1987 rates. As against this, an expenditure of Rs.414.50 crores had been incurred till March 1997 and irrigation potential of 1,68,065 hectares had been created till the end of January 1998. The Irrigation



Department had sought Rs.72 crores for 1998-99 to accelerate the work on Malaprabha Left bank and Right Bank canals.

The Hippargi barrage is another project in Karnataka whose cost has gone up by 10 times. The cost was originally estimated to be Rs.21.53 crores at 1970-71 rates and it was revised to Rs.186.70 crores at 1985-86 rates. But the project has been allowed to languish, the total expenditure on it till the end of March, 1997 being a mere Rs. 23.76 crores. Similarly we can see many projects dragging with time and cost over run.

Some projects worth mentioning for their successful completion in respect to all the three dimensional criteria are the Kudremukh iron ore project, the aluminium project by the National Aluminium Company (NALCO) and the Asian games complex project. These stand as glowing examples of public sector projects completed within estimated time and expected cost.

### **3.3 TIME AND COST OVER RUN IN PROJECTS IN KERALA**

Kallada Irrigation Project was started in the year 1961 with an estimated cost of Rs.13 crores. 500 crores of rupees have already been spent for this project. It has been estimated that an additional expenditure of about Rs. 120 crores have also, to be spent for the completion of its first phase.

The work on the Kakkad Hydroelectric project began in 1979 with an estimated cost of Rs.18.60 crores and it was revised four years later to Rs.41.17 crores, It was again revised to Rs.68.8 crores to complete it by 1990 but reached Rs.108 crores in 1996 (Fig. 3.3.1) with completion of work nowhere in sight, Collective irresponsibility may be the term best suited to describe the staggering of work on this project. The State Government, the Kerala State Electricity Board, contractors as well as trade Unions, by acts of commission or lent their mite in delaying its completion.

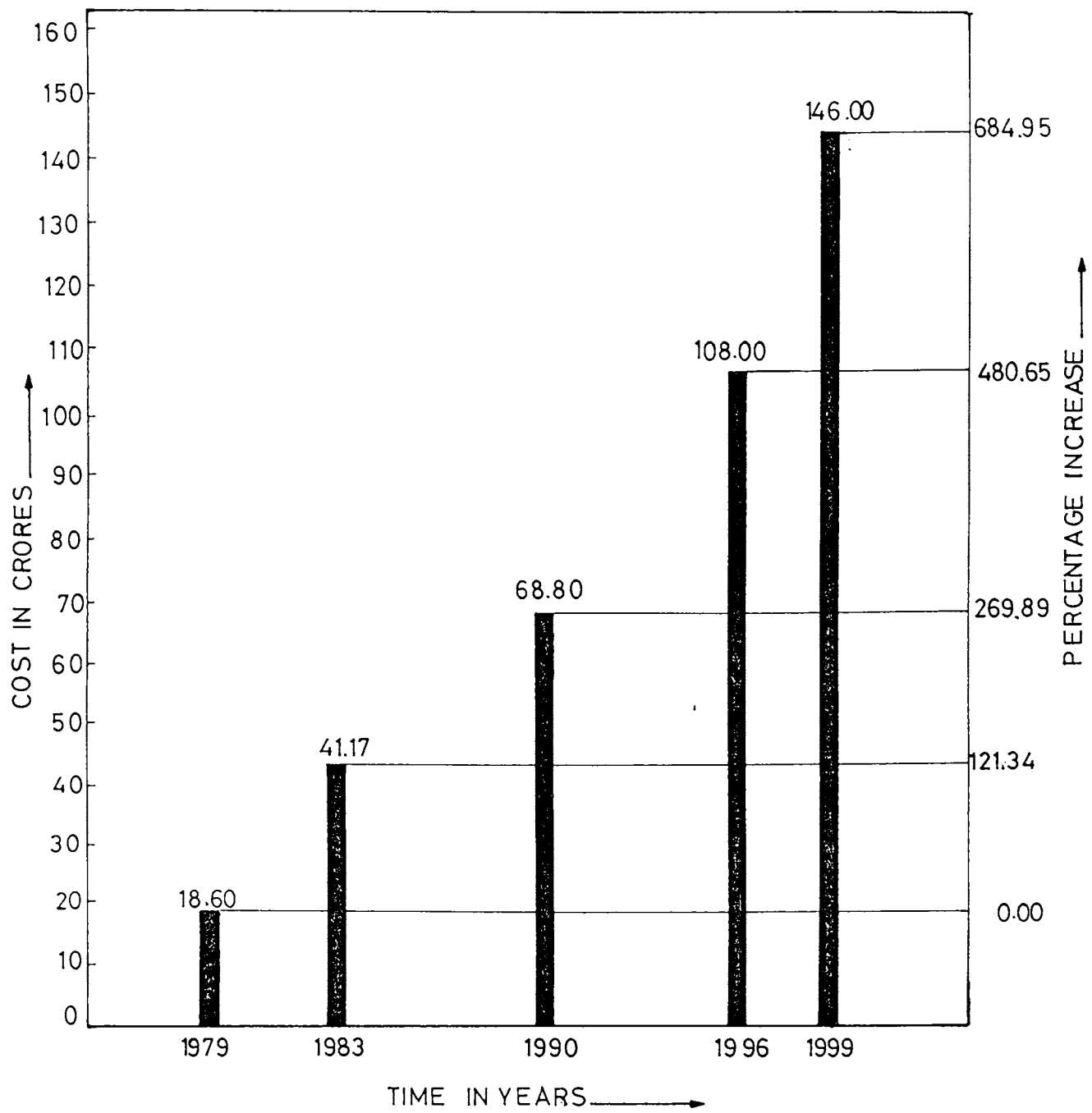


Fig.3-3-4 CONSTRUCTION COST\_ KAKKAD RPROJECT

The project envisaged the second stage of development of the tapping of the hydro-electric potential of the river Pampa by using the tail-waters of Sabarigiri project flowing from the Moozhiyar power house and the Veluthode and Moozhiyar streams for power generation. The KSEB has incurred a heavy loss on the project as its commissioning originally scheduled for 1984 had been postponed more than once for various reasons.

The project work was delayed many times following strikes by the workers as well as contractors. The contractors had stopped the work for 11 months in 1995-96 following a tussle between them and the KSEB on payment. There were also allegations that a section of KSEB officials had joined hands with the contractors to delay the work. The trade unions had also allegedly adopted double standards on many occasions causing bottle necks in the progress of the project work. The assurances on an early commissioning of the project made by the Power Ministers of both the LDF and the UDF in the past proved hollow and the project with its slow pace of progress has been made a black mark on the KSEB machinery itself. Once, the power tunnels drilled from the two ends of Pannikunnu and Seethakkuzhy went in two different directions due to the flaws in the survey. This has caused an additional drilling of 250m and a delay of seven months, besides a loss of more than Rs. 75lakhs.

Then Electricity Minister, last year visited the Kakkad project site and held discussions with the KSEB officials on the early completion of the project. The KSEB Chief Engineer(civil) has been posted at Kakkad to monitor the progress of the work and then the Board Chairman was told to conduct periodical assessment of the work.

Though the minister and the KSEB chairman had repeatedly said that the work on the project would be completed by October, 1998, it has not been completed accordingly. However, the trial run of this 50mw project had been done successfully on 9<sup>th</sup> June, 1999 at Seethathode Power House.

After a long wait of 20 years, the Kakkad Hydro Electric Project In Pathanamthitta district entered the power map of the state on July 12, 1999. One of the two 25mw generators of the 50mw Kakkad power project at the Moozhiyar power

house started generating electricity on a commercial basis on that day. The other 25 mw generator could generate power by July 16, 1999.

The two reservoirs across Veluthode and Mozhiyar streams had been completed 10 years ago. Though the work on the power project began in 1979 with an estimated cost of Rs. 18.60 crores, the cost works out to Rs146 crores when it is completed in 1999.

The Kakkad project would provide 262 million units of power a year and this would help provide five lakh new domestic connections in the state. The experts in the power sector assess a loss of revenue of not less than Rs.150 crores to the Government through power production alone with the inordinate delay in the commissioning of this project following strikes by workers and contractors on many occasions.

The construction works of the, Lower Periyar Hydro Electric Project's power tunnel was entrusted with the Hindustan Construction Corporation (HCC) with an agreement to complete the construction within 68 months from February 1984. The date of completion was September 26, 1992 but was extended to June 30, 1993. When the work was nearing completion, the HCC submitted a claim in May 1994 for compensation for the delays in the execution of the project. The Kerala State Electricity Board had in 1993 constituted a high power committee to look into the claim. The committee had recommended a compensation of Rs. 8.08 crores. A sub committee appointed by the Board had gone into the issue and endorsed the recommendations of the committee. In April, 1994, the Board sanctioned Rs 2.50 crores as an interim payment as recommended by the committee which shall be adjusted against the final amount payable to the HCC. Later, the Board unanimously decided to accept the recommendation of the committee. However, no payment had been made despite repeated requests for implementing the above decision. Pending appeal the Board issued an order in the month of March, 1997 cancelling the earlier decisions of the Board to pay the compensations to the HCC. The Board contended that it was the sole authority to decide on the payment of compensation.

But, a Division Bench of the Kerala High Court in the month of December 1998 directed the Kerala State Electricity Board to pay the Hindustan Construction Corporation within three months a compensation of Rs 8.08 crores for delay in the execution of construction works of the Lower Periyar Hydro Electric Project's power tunnel. The Bench also directed the Board to implement the order of April 1994 sanctioning an interim compensation of Rs 2.5 crores to the company for the delay in the execution of the works caused due to the Board's actions. The Judges issued the orders while allowing a writ appeal filed by the HCC against a single Judge's order disposing of its writ petition. The single Judge while declining to issue a direction for implementing the April 1994 decision directed the Board to take a decision in this regard.

The court said that from the facts it was clear that the HCC which had completed the major portion of the project was suffering from acute financial constraints due to delay in the completion of the project during May 1992. The court pointed out that the high power committee had a Board member in it. It was clear that there was no objection or dissenting opinion in the report of the committee. In other words the recommendation of the committee was unanimous. Even the sub-committee did not differ from the committee. The court said there was no justification or valid reason to with hold the payment. In the absence of any plausible reasons for not paying the amount, the order cancelling its earlier orders was actuated by malice in law and could not be sustained.

However, it is learnt that Supreme Court of India has stayed the High Court's Judgement.

The Karapuzha Irrigation Project has turned out to be another Kallada, a black hole devouring government funds. The work on the Karapuzha project, aimed at increasing paddy cultivation in Wayanad District, began in 1978 at an estimated cost of Rs. 7.60 crores. It was scheduled to be completed during, the Fifth Plan period (1975-80). The project is yet to be completed.

The Karapuzha project was aimed at increasing paddy production by 38, 950 tonnes in Vythiri and Sulthan Bathery taluks by providing irrigation facilities to an ayacut area of 9,300 hectares. The project envisaged construction of an earthen dam across Karapuzha river at Vazhavatta with a length of 624 meter and a storage capacity of 76.50 mm (2.7 TMC). A concrete gravity dam, three earthen saddle dams at Pakkam, Cherupetta and Chingeri, Left Bank main canal of 16.74 Km, right bank main canal of 8.8 Km and a net work of branch canals and distributaries having a total length of 106.64 Km were the other features of the project.

In its note to the Accountant General of Kerala, the State Government said the work had been stalled owing to the delay in the acquisition of land and completion of investigations, inadequate provisions of funds and changes in the original design of the spillway. By the end of March 1997, the Government had incurred Rs 63.73 crores on head works and Rs 43.31 crores for canal works. The state Government availed assistance of Rs 50 crores in 1995-96 and 1996-97, at 14% interest from NABARD under its rural infrastructure development fund for completing the project by March 1997. But 20 percent of the work on the spillway and major portion of the canal system still remained incomplete. The original project report envisaged the construction of a masonry spillway in the central portion of the earthen dam on either sides. But this was not found to be feasible because of the soil conditions. Several alternatives were considered and finally, based on the 1992 Expert committee recommendations, the Government decided to construct a concrete spillway. But, till March 1997, only 70 percent of the work was completed at a cost of Rs 46.24 crores. Even though Rs. 9 crores was spent on land acquisition, only 33.45 hectares, out of the 250 hectares identified for the project was acquired. The reason: there were no surveyors and chairmen.

According to the figures available in the latest report of the Controller and Auditor-General of India, huge amounts were diverted and utilised for other purposes. One case related to the failure of the Irrigation Department to recover the cost for the project land handed over to the Forest Department for compensatory afforestation. The CAG's report said that the original project proposal envisaged only production of paddy in 4,650 hectares. But, in the revised project report out of the net ayacut area of

5,221 hectares, paddy cultivation was limited to 3,500 hectares and the balance was set apart-for banana (161 hectares), ginger and vegetables (100 hectares). The reduction in the area for paddy cultivation, the government informed the CAG, was because of the shift in cultivation.

The investigation of the CAG found that the huge loss was caused due to the non compliance of the accepted practices and procedures followed in the Public Works Department.

The audit also found that rehabilitation of 218 tribal families, evicted in 1978 from the reservoir area of the project, was a non-starter. After a delay of 16 years, a rehabilitation package at a cost of Rs 76.30 lakhs at a rate of Rs 35,000 per family was approved. Although only 161 families could be identified by September 1996, the entire outlay of Rs 76.30 lakhs was drawn and kept in the treasury public account in the name of the District collector. A sum of Rs. 19.95 lakhs was drawn for the rehabilitation of 57 families which were not identified. Even though the authorities said the construction of houses would start no action had been taken, the report pointed out.

The uncertainty in the commissioning of the 2.5 Mw mini hydel project which envisages the use of the waters of the Malampuzha dam for power generation has caused much loss to the state on the power front. This ambitious project, proposed to produce 5.6 million units of power a year, was launched in 1989. It would have been completed within a year had the works progressed as per the schedule. The contract was given to a Chennai –based private firm which, it is alleged, had no previous experience in such projects, according to KSEB sources. Being a turnkey project, the design, supply and installation works were given on contract to the firm for Rs 2.5 crores. The civil work was done by the KSEB. Though the company started the erection work in 1992 it took as many as four years to do the trial run. But during the trial run held in 1996 some defects were noticed in the butterfly valve. The major defect was that it could not work under different pressures. This was rectified subsequently. In 1997 another attempt was made to commission the project, but again during the trial run a valve disc got broken. The spirickal valve also developed some

problems and hence pressure equalisation could not be done in the system. A big size motor was installed to solve the problem.

However, even after a couple of years' of 'trial and error' experiments the project could not be commissioned. The present problem is that the butterfly valve's performance is only 60 percent even as the KSEB officials insist that the project could not be commissioned unless the performance is 100 percent, as the control of water from the dam is done by the valve. If there is any dripping the valve has to be closed within a few minutes. If this is not possible there could be major accidents due to the rush of water through the valve.

The Malampuzha mini-hydel project is one of the first projects planned in the state to generate power from the water let out from a dam for irrigation purposes. Not only the water let out –for irrigation but also the water emptied out through the shutters during rainy reasons-when the dam crosses the danger level-could be used for generating power. The Malampuzha project is the first single turbine manpower project in the state. The other mini-hydel projects taken up later such as the Peppara and Mattupetty projects, had already been commissioned. The KSEB authorities are not sure when the Malampuzha project will get completed. The total cost of the project is Rs 3.6 crores. Of this, the machinery of the project cost Rs 2.5 crores and a major part of it had been paid to the private company, Board officials said. They said that ever since the company got the payment from the Board there has been delay in completing the project.

KSEB authorities said that once power is generated from the project the entire Malampuzha Panchayat and the Malampuzha tourism complex could be provided with power from there. Arrangements are already made for feeding power to an 11 KV line. This will help avoid transmission loss as well.

The Pazhassi project was started 40 years ago with an estimated cost of 4.42 crores. Even after spending a multi-fold of estimated cost, the project still remains incomplete.

Muvattupuzha –Valley Irrigation project (MVIP) is one of the most important irrigation projects in the state. Besides providing irrigation facilities in Idukki,



Kottayam and Ernakulam districts, it also envisages supply of water to various industrial concerns and drinking water to the public in these areas. The estimated cost of the project in 1980 was Rs 48.08 crores. In 1990, it was re-estimated at Rs. 104.26 crores. In the 1996 schedule of rate, it was revised to Rs 383 crores.

It is suspected that the delay and cost over run caused on account of the introduction of new system of “contractors own materials”, ranking contractors for Pre-qualification works and the change in tender system etc. Under “Contractors own materials system” the contractors would procure materials like the cement and steel and would be paid at market rates. This was against the then prevailing system of materials being supplied at Government controlled rates. Contractors have been paid market rate for materials supplied by them even without the verification of purchase bills. The magnitude of the cost over run after the introduction of pre-qualification of contractors could be gauged by comparing the amount quoted for PQ works with that of works executed through open tenders during the same period.

The work was held up due to vigilance probe into the irregularities. The stoppage of work had also escalated the cost of the project. Recently, the Kerala High Court has said that it is for the State Government to decide whether the work on the Rs.388 crore (Fig. 3.3.2). Muvattupuzha Valley Irrigation project should be resumed or not.

The regulator –cum causeway built across the Anjarakkandy river at Parapram near Thalassery as part of a minor irrigation project to prevent salinity intrusion in vast stretches of paddy fields and farm lands lying on either side of the river is in a bad state of disrepair. The extremely corroded structure stands a monument to the unfulfilled objective of the project that remains incomplete even four decades after it was launched. Substantial sums from the exchequer have already gone down the drain for this minor irrigation project which is now almost abandoned. It has been years since the Public Works Department or the Minor Irrigation Division conducted any maintenance work on the 17 shutter regulator and the navigation lock that have corroded beyond repair and revival. The dilapidated barrage-cum-cause way that links Parapram and Cherumvilayi villages is also posing a threat to the people who use it to cross the river.

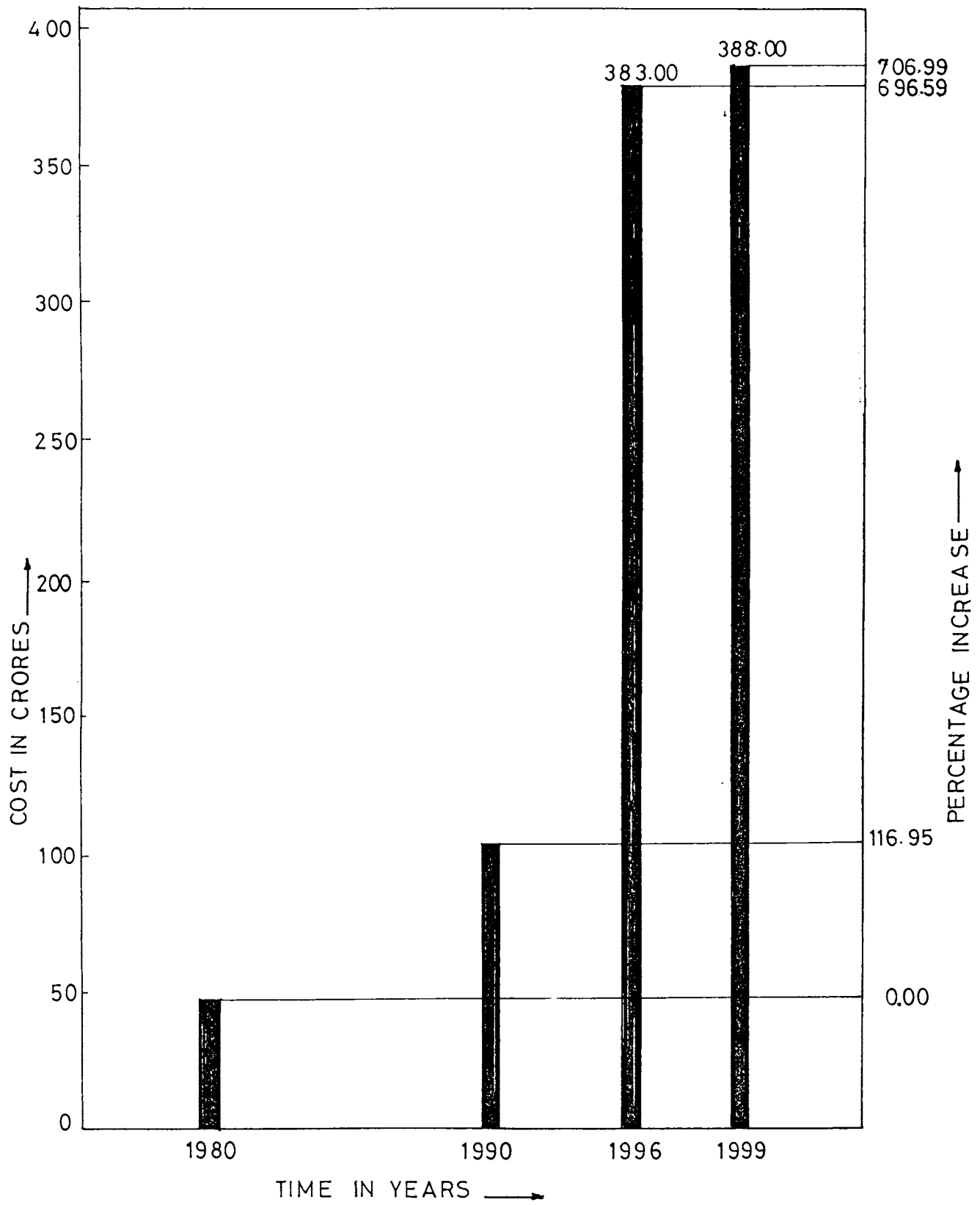


Fig. 3.32 CONSTRUCTION COST MUVATTUPUZHA VALLEY IRRIGATION PROJECT

The project drawn up for the benefit of the people of Peralassery, Pinarayi, Vengad and Anjarakkandy Panchayats was sanctioned soon after the installation of the EMS-led Ministry in the State in 1957. The foundation stone for the project was laid in the same year by the then Irrigation Minister, who represented Thalassery Assembly constituency. The project envisaged the construction of a regulator across the river to protect paddy fields and farmlands as well as ground water resources in these Panchayat from salt water intrusion. The objective was to irrigate about 1200 hectares of land and to convert the single crop cultivation in the areas into multiple crop cultivation.

The work on the project was started in 1959 with an estimated cost of Rs.9.27 lakhs and it came to a halt following the dismissal of the EMS Ministry, till 1965 when the work on the cause way was started following an agitation by the people from the areas. Two years later, the work on the regulator was taken up with a revised estimate of Rs.37.4 lakhs. Though the project was partially commissioned in 1969, salt water continued to flow into paddy fields and homesteads destroying crops and contaminating the ground water in the absence of a navigation lock as part of the project.

According to farmers in the area, the project – served its purpose for about six months after it was commissioned in June 1989. The salt water continues to devastate the area as all the 17 shutters of the regulator are rusted. Minor Irrigation officials here say that the regulator can be revived only by replacing the worn out shutters and erecting a new concrete lining underneath the water. The existing concrete linings, on which the bottom of the shutters rested, caved in creating a wide gap between the shutters and the linings.

The people in the project areas say that the regulator and its shutters have been seriously damaged so soon because of the poor quality of the work and the low cost materials used. There is considerable decline in the arena under cultivation over the past several years. The grave problem that the people living on either side of the river now faces in the contamination of ground water with salinity, especially during summer months. Even the causeway on the regulator cannot be used for long if there is no

attempt do some maintenance work. The railing along the causeway has been rusted posing danger to children using it.

The work on the Chimmini Irrigation Project was started in 1975 with an estimated cost of Rs.6.32 crores. But after 20 years, when the project was commissioned on March 5, 1995 the cost had gone up to Rs.55 crores. The original idea was to use the water to irrigate 13,000 hectares of 'Kole land in Thrissur, which was estimated to raise the paddy production in the area by 77,000 tonnes a year. But even after four years of its commissioning the project has not been able to serve its original purpose.

In fact, serious doubts have been raised about the safety of the dam in view of the leaks. According to reports, the authorities are unwilling to fill the dam to its full capacity for fear of serious breaches. The water is being regularly let out through the shutters to ensure that the water level will not raise to unbearable heights. The dam has a total length of 1211.34 metres, of which 524.84 metres is of masonry and 686.50 metres earthen dam. The maximum height of the dam is 54 metres and the spillway is located in the masonry portion. The reservoir is estimated to have a storage capacity of 179.39 million cubic metres with a live storage of 176.39 million cubic metres.

The Estimates Committee of the Assembly has expressed concern at the slow pace of work on the Vizhinjam harbor. In its ninth report submitted to the Assembly in the month of July, 1998, it pointed out that the work was started in 1962. The original decision was to complete it within five years in 1967. But none of the stages of the work had been completed so far. The third stage of the work was being done now. The Committee pointed out that the eviction and rehabilitation of the residents from the project area too was yet to be completed though it had made much progress. The panel stated that according to the Government's report work on the third stage had begun on the available land. It asked the Government to inform it of the progress of the work and when it could be completed.

When the Chief Minister launched the dredging work of the Tangassery Break water Project second phase in the month of May, 1998, it was announced that the work

would be completed in six months. However, the work has not been completed yet, even after one year.

The contract for dredging was awarded to the Public sector undertaking of the Kerala, the Kerala State Maritime Development Corporation Limited, for Rs.2.44 crores. The job is to reclaim an area of 4.65 lakh cubic metres from the sea for accommodating the various buildings and other civil construction which are planned at the project site. Any delay in reclaiming the area would hit the project.

The project is reportedly the first of its kind in the country for the benefit of traditional fishermen. It offers a wide range of facilities for the fishermen and also would help increase the number of their working days by about 70 from the existing 180 days. Fishermen on the beachfront said they had rarely seen the dredger in operation during the last four months. On the other hand, the crew when contacted said that given the adverse working conditions they had produced more than what could be expected. They alleged that the dredger itself was in a very bad shape needing repairs and replacements almost everyday. Purchase of spares could be done only by obliging formalities and hence time consuming whenever something went wrong. For some time, the dredger had been fraught with a serious mechanical problem due to clutch alignment snapping, the crew members said. Added to that were the problems on the sea bed which was littered with hard rocks and synthetic sacks that blocked the dredging gadgets. This resulted in the operations coming to a grinding halt for the purpose of cleaning the gadgets. "We never expected such hindrances while taking up the contract" they said. However, sources said the contract was taken up after a detailed survey of the area and that such objects getting sucked into the dredger was common.

The construction of the recently inaugurated Kumbalangi - Perumpadappu bridge was started 13 years ago in the year 1986, with an estimated cost of 1.5 crore. When it is completed, the cost worked out to Rs.8.78 crores for this 215 m. long bridge.

When the Kerala State Construction Corporation withdrew after spending more than half the estimate, only 12 percent work had been completed. The work was

entrusted to a private company in 1993 which also over shot the period of two years, but completed the work last year. The Chief Minister who congratulated the people of Kumbalangi for their dream of a bridge came true, said his Government had taken special care to see that such long over-due projects were being completed in times. It was in 1980 that the preliminary sanction for the bridge was granted but successive ministries that came to power later failed to complete the work.

The construction of the Varapuzha bridge was commenced in June 1995. As per the contract, the work should complete in July 1999. The progress of the work has been badly affected due to the frequent labour strikes, according to the contractors, Bhagheeratha Construction Company. Now seventy five percent of the work only has been completed. One thing is definite, the project will not be completed within the expected time.

The Pariyaram Medical College project for setting up a medical college and the super speciality hospital in the co-operation sector was conceived by the then co-operation Minister has come a long way since its foundation stone was laid in 1994. The Medical College project being developed in a sprawling 119 - acre land at Pariyaram comprises a 1000 bedded hospital block, the college block and the clinical consultancy block which are nearing completion. Though the original cost of the project cost was estimated at Rs. 195 crores, the project cost was revised to Rs. 232 crores. While the construction work of the clinical and college blocks had already been completed, the hospital block is in the final stages of completion. According to the Medical College Principal, that the works including infrastructure works would be completed by March 2000 as nearly 80 percent of the total construction works were completed. The six storeyed clinical consultancy block with a total area of 3,700 sq. metres houses clinical rooms of the offices of the heads of departments and is linked with the two other blocks. the total area of the six-storeyed college block has 35000 sq. metres. This block consists of nine lecture halls of 400 sq. metres each, a 959 sq. metre lecture hall and a 1200 sq. metre library hall. The novelty of the construction is that the large halls are column - free because of the use of pre-cast waffle slabs. The eight - storeyed hospital block consists of 10 blocks arranged radially around a core block. While the structural work of the hospital block having a total area of 70,000 sq. metres

has been completed, finishing works are in progress. The hospital block will have 20 operation theatres. As many as 20 lifts out of the total 24 proposed in the Medical College will be located in the hospital block. Other amenities in the block include centralised air - conditioning information system, medical gas pipe line etc. The total cost of the hospital block is estimated at Rs. 42.29 crores.

As the power requirement of the Medical College is about 3 MW, the Government has sanctioned a dedicated 11 kv feeder to it. The college authorities have called for tender for two 1.25 MVA diesel generators for standby generation. Plans are also on to install stabilisers and UPS in operation theatres and other life - saving devices. Work on the water supply project of the Medical College is also nearing completion. Besides the proposed students' hostels and staff quarters, the facilities provided in the Medical College project include stadium, community centre, guest house, shopping complex, primary school, police station, fire station and telephone exchange. Though the Medical College works were affected in the past due to acute shortage of funds, the college management is optimistic about completing the works on time.

As listed out above, it can be seen that many projects in Kerala Public Works Department and other Govt. departments are dragging with project time and cost overruns. The under performance points towards the effectiveness of our methods and practices.

### **3.4 NATIONAL LOSS ON ACCOUNT OF DELAY IN CONSTRUCTION**

Two cases of construction projects in the eighties have been presented here to estimate loss to the nation on account of delay in construction. Construction delays, primarily due to outdated methods of construction and its management, have caused enormous losses to the nation both by way of escalation in cost and by way of production loss due to delayed possession of a planned facility. Two examples are worked out to show the magnitude. (Zacharia George, 1993)

- (i) The construction of a 400 MW power generation project.

Design of the project could virtually be done without delays in construction. Computing methods can at best marginally speed up delivery of details to the construction sites. Construction of such a project takes 4 to 5 years. If an early completion by one year is possible, we can see the production gain, direct and indirect. Apart from this, early completion saves the project from effects of escalating costs.

#### Power Generation

$$\begin{aligned}
 (400 \text{ MW} \times 1000) &= 1728 \text{ million units} \\
 (24 \text{ hours} \times 30 \text{ days} \times 12 \text{ months}) &= \text{Valued at about Rs. 600 Million} \\
 \times 50\% \text{ capacity utilisation} &
 \end{aligned}$$

User industry's production gain: valued assuming cost of power to be 5% of production cost - 20 times the cost of power used. = Rs. 12000 Million

#### (ii) Construction of a road bridge

A new bridge replaces an old and narrow one where traffic had to be slowed down or stopped.

$$\begin{aligned}
 \text{Vehicles passing in a day} &= 5000 \\
 \text{Delay at bridge} &= 30 \text{ seconds/vehicle} \\
 \text{Total petrol burnt} &= \text{Say 250 litres (a)} \\
 \text{Time lost (estimate)} &= 40 \text{ machine hours (b)} \\
 &200 \text{ man hours (e)}
 \end{aligned}$$

$$\begin{aligned}
 \text{Direct loss/day (a) } 250 \times 6 &= 1,500 \text{ rupees} \\
 \text{(b) } 40 \times 25 &= 1,000 \text{ rupees} \\
 \text{(c) } 200 \times 5 &= \underline{1,000 \text{ rupees}} \\
 &\underline{3,500 \text{ rupees}}
 \end{aligned}$$

Construction delayed by one year equals to a loss of = Rs. 1.10 million.



From these examples, the inter-dependence of construction on infrastructure and the national production is clear.

These examples are shown to illustrate the economic gains that can be brought about through better construction method, equipment, management and training. These will, however, need extra investment in the beginning.

### **3.5 UNWORKABLE ESTIMATE**

Normally the detailed estimate of a project is prepared based on a Schedule of Rates that is published by various government agencies, every few years. These Schedule of Rates do not reflect market reality since they are not always based on actual market surveys. The fluctuation in prices is very frequent and the government departments have no authority to make estimates based on prevailing market rates. So the estimated cost of a project based on the official schedule of rates becomes unrealistic even before the project is taken up. By the time the project is complete, the gap between the official cost and the actual cost becomes very large.

The official prices are always lower than market prices since the Schedule of Rates in force from time to time is not the actual/current rates. The estimated cost of the project does not take into account the increase in price between the period the estimate is prepared and the project is started. It also does not take into account the increase in cost during the period of project execution. It does not consider key project constituents as a result of the Government budget which puts on additional burden on the project cost, apart from normal inflation. The estimate project cost also does not take into account the likely increase in the cost of the project as a result of changes in the international economic situation such as devaluation of national currency, increase in P.O.L. etc.

Suppose a state Government organization is preparing an estimate for a Housing Project in Cochin. The estimate will be prepared based on Kerala PWD Schedule of Rates July 1999. The Schedule of Rates 1996 has been revised w.e.f 1.7.1999, after a

lapse of 3 years. If the commencement of the project is July 2000 and the stipulated time of completion is July 2002, let us think it in a realistic approach.

When the tender for that project is floated, the contractor will quote higher percentage above the estimate rate. This is to compensate for the variation in the Schedule of Rates based on which the estimate is prepared and the prevailing rates and towards their profit. Generally, the tender rate will be higher than the normal escalated rate. This difference can only be attributed to the extra margin of the contractors of the project.

Based on the above discussion a correction to the estimate for prevailing market rates has to be adopted, to make it realistic.

### 3.5.1 EQUATION FOR THE CORRECTION FOR ACTUAL MARKET RATES

Attempts have already been made to assess the cost of escalation (Abdul Salam, 1989). The Building cost Index of Cochin for the ten years was calculated and the Escalation percentage has been computed for each year. Cumulative Escalation percentage was worked out (Vide Table 3.3) and a graph of Escalation percentage Vs year of construction was drawn (Fig. 3.5.1). From that study the escalation rate computed was 14.29% say 15% per year. It is rational taking into account the hike in material cost and other factors of construction. This percentage of 15 shows close correlation with the escalation rate even after a decade, since it is evident from the current Schedule of Rates 1999 the rates of which are 45% above (average) the rates of 1996 Schedule. That is, the escalation rate is 15% per annum.

Corrected estimated cost in 2<sup>nd</sup> Year-

$$C_1 = (E + 0.15E) = 1.15 E \dots\dots\dots(3.5.1.1)$$

Corrected estimated cost in 3<sup>rd</sup> Year-

$$C_2 = 1.15 \times 1.15 E = 1.15^2 E \dots\dots\dots(3.5.1.2)$$

Where

E - Original estimated cost

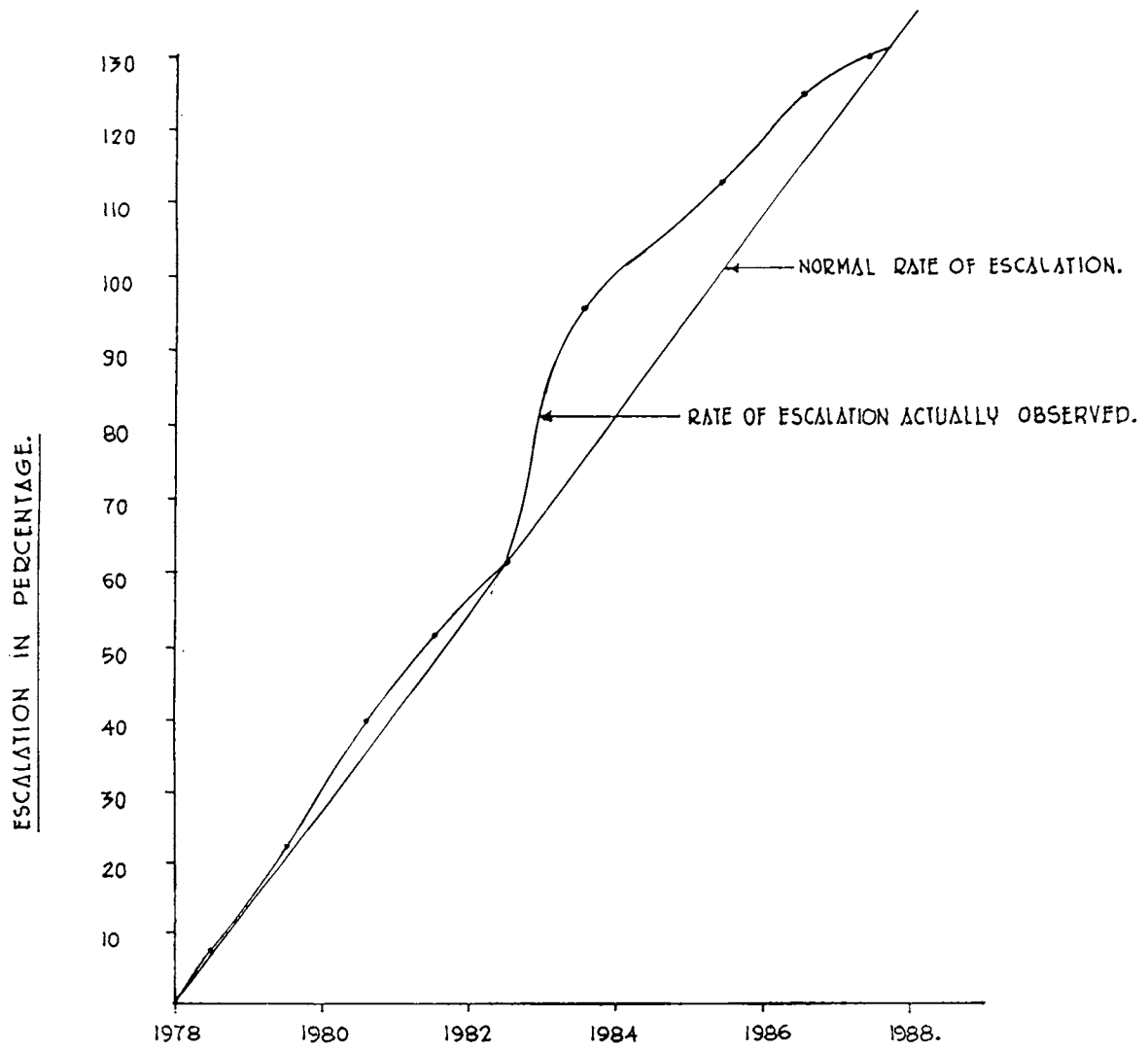


Fig. 3-5. YEAR OF CONSTRUCTION.

The equation can be generalised as

$$E \text{ corrected} = (1.15)^{n-1} E \dots\dots\dots (3.5.1.3)$$

Where E corrected - Corrected Estimated cost in the n<sup>th</sup> year.

n - number of years elapsed

E - Original estimated cost

**Table 3.3 Cumulative Escalation**

<b>Year of Construction</b>	<b>Percentage</b>
1978-'79	8.87
1979-'80	21.65
1980-'81	39.77
1981-'82	52.73
1982-'83	61.04
1983-'84	95.47
1984-'85	104.36
1985-'86	111.71
1986-'87	121.10
1987-'88	128.45

Thus the project cost will be 45% more than the estimated cost or the original estimated cost of the Housing Project will be 45% less than that prepared in the year 1999, after taking into account the market reality.

By adopting the above equation the reasonableness of the tender premium can be examined and evaluated. Suppose if a contractor quotes 70 percent above the estimated rate, the extra profit/margin of the contractor will be (70 - 45 = 25%)

Now, the practice followed in PWD is that the tender with more than 35% excess has to be approved by a Tender Committee consisting of Govt. Secretary, Chief Town Planner and Chief Engineer before the work is awarded to a contractor for execution. But, from the above discussion, the system can be changed in such a way

that the tender with a rational escalation percentage, adjudged by adoption of the equation, can be awarded by the Chief Engineer, without sending it to the Tender Committee for the acceptance. In doing so, the delay can be averted. The implementation of this system in State PWD can be thought of.

### **3.6 SELECTION OF COMPETENT CONTRACTORS - LOWEST QUOTATION APPROACH**

While a lot of care is taken in the preparation of estimates, tenders, detailed specifications and schedule of rates, the same cannot be said of the selection of contractors. Selection of contractor, especially in government departments and in public enterprises, is invariably done based on the lowest quotation. Usually no performance, his technical skills and expertise, machinery available and financial capacity are considered.

The lowest quotation approach can be accepted if quotations from equal and comparably efficient contractors alone are considered. In practice, it is not so. Very little has been done to standardise the competence and reliability of contractors. Only an attempt has been made by the system of registration of contractors. This has become a mere formality. At present under a typical government method, contractors are classified under Class A, B, C and D and limits are given for the value of each work he could bid for. In Kerala Public Works Department, the financial limits specified for various classes of contractors are as follows.

A - Class Pre-qualified - No monetary limit

A - Class contractors - Upto Rs. 140 lakhs

B - Class contractors - Upto Rs. 55 lakhs

C - Class contractors - Upto Rs. 15 lakhs

D - Class contractors - Upto Rs. 6 lakhs

The lowest bid is sometimes based on highly unworkable rates also. With an intention to get the work, the contractor quotes the lowest rates which are sometimes unworkable.

An engineering contract like any other commercial activity is based on the profit motive. No contractor can be expected to invest without the aim of a reasonable economic return on investment. It can be imagined what sort of returns a contractor is expected to get when the estimate itself is based on unrealistic rates and the work has been awarded to the lowest bidder.

### **3.6.1 NEED FOR A MODEL PROCEDURE FOR THE SELECTION OF A CONTRACTOR**

At present the contract is awarded to the lowest bidder as a matter of course. This system has got many drawbacks. Other parameters such as technical skill and expertise, reliability, better performance, quality of execution of work etc. have not been appreciated fully in this system. If a sole criterion alone is considered for the selection of a contractor the element of favouritism will play a role. Lowest bid is not necessarily the only criterion to accept the tender. A paradigm shift from this state of affairs has become a necessity. In this connection a modern approach is required from the part of all concerned in the construction industry. Three criteria to be considered are (1) Registration of contractors as prevailing in PWD (2) Fixation of limits of his bid capacity and (3) Selection through Performance Rating.

### **3.6.2 BID CAPACITY OF A CONTRACTOR**

In many of the projects, no limit has been fixed to a contractor for his capacity to execute any quantum of work in a given period. This means there are cases where a contractor with Rs. 140 lakhs registration, bids for and takes a Rs. 14 crores worth of works in a year. There is no relationship with his financial capacity or technical competence. Thereafter, he subcontracts the work to others for a nominal fee. This defeats the entire purpose of registration of contractors. So there is a need for fixing a bid capacity. If a contractor has got a financial capacity of Rs. 25,00,000, if he takes up number of works, the capacity has to be multiplied. More number of works mean diversion or possibility for lack of concentrated effort. Hence one who is currently doing more works is not a desirable contractor.

### 3.6.2.1 FIXING CURRENT BID CAPACITY

The equation available in certain tender documents for the calculation of bid capacity is

$$C = A \times N \times 2 - B \dots\dots\dots (3.6.2.1)$$

(QUOTE: TENDER CONDITION OF N.V.D.A.)

Where A - Maximum value of Civil Engineering work executed in any one year during preceding 5 years updated to the current price bid, which will take into account the completed and on going works.

B - Value of existing commitments and works (ongoing) to be completed during the period of completion of work for which bids are invited updated to current price level.

N - Number of years prescribed for completion of work for which bids are invited.

Example:

A = Rs. 2645.31 Lakhs - Vide statement No. 1

B = Rs. 7344.50 Lakhs - Vide statement No. II

N = 1.75 years

$$\begin{aligned} \text{Bid capacity } C &= A \times N \times 2 - B \\ &= 2645.31 \times 1.75 \times 2 - 7344.50 \\ &= 1914.085 \text{ lakhs} \end{aligned}$$

Statement No. I

**STATEMENT FOR DETERMINING 'A' VALUE I.E. THE MAXIMUM VALUE OF CIVIL ENGINEERING WORKS EXECUTED  
IN ANY ONE YEAR DURING THE LAST FIVE YEARS (UPDATED TO THE CURRENT LEVEL) WHICH WILL TAKE INTO  
ACCOUNT THE COMPLETED AND ONGOING WORKS.**

Sl. No	Year	Page Nos. of audited annual report of the year.	Total value of civil engineering works done during the year excluding advances such as mobilisation advance, machinery advance and including 50% value of joint venture works. Rs. in lakhs	Updated value in Rs. lakhs
1.	1993-94	23 & 4	1350.93 + (281.37+179.56) = 1811.86	1811.86 x 1.46 = 2645.31
2.	1994-95	23 & 4	1417.58 + (263.89 + 208.99) = 1890.46	1890.46 x 1.33 = 2514.31
3.	1995-96	23 & 3	1222.20 + (396.27 + 158.38) = 1776.85	1776.85 x 1.21 = 2149.99
4.	1996-97	23 & 3	1149.16 + (327.18 + 134.29) = 1610.63	1610.63 x 1.10 = 1771.69
5.	1997-98	26 & 5	2079.16 + (270.37 + 54.27) = 2403.80	2403.80 x 1.00 = 2403.80
Maximum value of works done during 1993-'94 the value "A" = Rs. 2645.31 lakhs				



Statement No. II

**STATEMENT DETERMINING "B" VALUE, THE VALUE OF EXISTING COMMITMENTS AND ONGOING WORKS TO BE COMPLETED DURING THE PERIOD STIPULATED FOR COMPLETION OF PROPOSED WORK**

Sl. No	Name of work	Year of commencement of the work.	Amount of contract of the work.	Balance cost as on the date of submission of document Rs. in lakhs	Value of works to be completed in the period stipulated for completion of the proposed work up dated to present price level
1.	Construction of Punasa Tunnel Narmada Valley Development Authority	November 1993	6232	3,000/-	3000 x 1.46 = 4380.00
2.	Diversion tunnel for the SVP Bhaba Augmentation project	October 1989	687	80/-	80 x 2.15 = 172.00
3.	Power house tail raise and switch yard for Kuthungal Hydro Electric Project	October 1997	272	175/-	175 x 1.00 = 175.00
4.	Ranganadi Main Tunnel of Ranganadi Hydro Electric Project for Neepeco.	November 1989	4515	150 /- (50% value taken since the work is executed on 50 = 50 basis with joint venture partner)	150 x 2.15 = 322.50

5.	Bridge across river Chaliar for National Highway	May 1997	1041	900/-	900 x 1.00 = 900.00
6.	Hospital complex at Alleppey	May 1997	509	350/-	350 x 1.00 = 350.00
7.	Sinking shaft at Sheethalohara	October 1997	731	600/-	500 x 1.00 = 500.00
8.	Twin Tube tunnels for M/s. KRCL in Maharashtra	April 1998	763	200/-	200 x 1.00 = 200.00
9.	Pullazhi Housing Scheme for K. S.H.B.	June 1998	264	225/-	225 x 1.00 = 225.00
10.	Guest House Alleppey	June 1998	83	60/-	60 x 1.00 = 60.00
11.	Essar Project construction of RCC sleepers and RCC Bridges for pipe track for Essar.	November 1997	362	60/-	60 x 1.00 = 60.00
Total					<u>7344.50</u>

Drawbacks of the existing bid capacity equation:

1. Many parameters are not included

The factor considered in the equation is the experience of the contractor in the contracting field. The main other parameters to be considered are

(a) Technical skill and expertise

Before a contractor is allowed to tender, his technical competence to perceive the work and to handle the situation for the successful completion of the project shall also be tested and verified along with his financial capacity. Verification of the capacity of the contractor will require information on his previous experience, technical skills, expertise and machinery and his financial status. His technical competence can be verified only after an inspection of the works executed by him and also the infrastructure available with him. This is not done in any of the government contracts normally. Based on his technical competence, the contractor should be allowed to bid only for specified kinds or areas of work.

(b) Reliability of the contractor

Very little has been done to standardise the competence and reliability of contractors. Before a contractor could be given registration verification of his reliability should be completed. The performance records and reliability of the contractor can be verified by referring to his performance records from the past contractees and also from his income tax returns.

(c) Performance of the contractor

It is necessary to keep on record the performance of each contractor, especially his promptness and quality of execution.

In the Andhra Pradesh Housing Board, a beginning has been made to keep the history sheets for individual contractors. At the end of one year, a review of the performance of each contractor will be made and a performance rating, similar to grade rating of financial institutions will be awarded. For this purpose, a computerised format has been evolved and basic data collected from all the contractors and put in the computer. Each contractor is given a code number.

Whenever a contractor bids for a contract, his bio-data and history sheet has to be examined. By keeping track of the volume of contracts already awarded to the particular contractor the quantum of work already executed, the balance of work to be done by him and his capacity to carry on this work are all assessed and made available. Based on these data, care has to be taken to ensure that before a contractor is selected, not only his quotation is most competitive but also his technical and financial capacity is sufficient enough to execute the work and the contracts already awarded to him and remaining to be executed which should not exceed or exhaust his full capacity. Similarly, his history sheet is also kept in view. As such, not only registration, but also competence and capacity of the contractor as well as his performance are kept in view before a considered decision is taken.

At the end of every year, review of the performance of each contractor based on the projects awarded to him shall be made and a performance rating shall be given to him. The Association or Federation of contractors should itself make a rating for contractors based on certain objectives and agreed yardsticks.

When projects are not completed within the stipulated time, apart from the loss of return from the project, due to the delayed completion, future effective functioning of the project also will be affected adversely.

(d) The quality execution of work

While half - hearted measures to evolve quality standards and implement them have been underway in Indian manufacturing industry, quality is a neglected factor in the construction sector. It appears that the slogan "Quality first, Quality always" is only

a myth, and the actual one is "Quality last, Quantity sometimes". The poor quality is due to the poor management by executing agencies. The details of quality execution of the contractors can be ascertained from the past contractees and clients. The contractor gets return on investment by lowering the quality of work and getting it approved by executing agencies.

2. The nature of projects is not reflected in the equation:

In 'A' and 'B' of the equation  $C = A \times N \times 2 - B$ , particular nature of the work is not specified. This is one of the drawbacks of the equation. In the equation, all the projects executed by the contractor are taken into consideration. If a contractor is considered for a road project, it will be more appropriate to give weightage to his experience in the road projects executed by him.

(UNQUOTE)

3. The escalation factor taken is arbitrary:

In the equation, the escalation factor taken for updating the value of work is found to be 10%. It is arbitrary. This factor has to be computed scientifically, considering the construction cost index. The cost index may be defined as a number that gives an indication of relative increase or decrease in cost of certain item or commodity with respect to its cost at certain base year. It is the resultant effect of the cost of various construction materials like cement, steel, wood, bricks and also labour components. The variation in the cost of the basic materials and labour will be reflected in the construction cost index over period of time. Supposing an estimate has been finalised in a particular year and due to some reason or other, it is tendered in next financial year, there could be tender premiums quoted by the tenderers. By adopting the cost of materials and labour at the time of tendering the current cost index can be worked out and this will help to substantiate the price escalation of materials and labour over the base year. This will also help to understand the reasonableness of the tender premium. The escalation rate per year shall be rational taking into account the hike in material cost and other factors of construction. In this light, the Kerala PWD Schedule of Rates is unrealistic. This factor has an indirect effect on the quality of construction.

The scope of this work does not cover the calculation of construction cost index.

### 3.6.3 SELECTION OF CONTRACTORS THROUGH PERFORMANCE RATING

Apart from registration of contractors and fixation of limits of his bid capacity the final selection of a contractor for a job/project shall only be after considering his performance rating. Unless a contractor has a satisfactory performance rating even his most competitive bid should not be accepted.

The performance of contractors can be assessed and graded by a Credit system. A contractor shall be declared to have successfully completed the requirements for the award of the work/project, if he has got relevant registration, bid capacity and acquires maximum credits.

Grades can be assigned considering the performance of the following parameters.

- (i) Technical skill and infrastructure

Depending upon the experience of the contractor in the works of similar nature for which bids are invited and the infrastructure available the grade points can be awarded.

For instance, if the tender floated is for a bridge project, the experience of the contractor in executing the bridge project can be considered.

The Performance factor ( $P_1$ ) for technical skill and infrastructure can be assessed by the following relation

$$P_1 = \frac{T_s + T_i}{2} \dots\dots\dots (3.6.3.1)$$

Where  $P_1$  - Performance factor for technical skill and infrastructure .

$T_s$  - Grade point for technical skill obtainable by the relation.

$$T_s = 1 + \delta_{n2} + \sum_{x=3}^n \frac{1}{X-1} \dots\dots\dots (3.6.3.2)$$

Where  $\delta_{n2} \text{ def } \begin{cases} 1 & \text{if } n \geq 2 \\ 0 & \text{otherwise (} n < 2) \end{cases}$

e.g. If a contractor has executed one bridge project, the grade point can be 1, if he has executed 2 bridge projects, the grade point can be  $1+1/2-1 = 1+1/1 = 2$ . If he has executed 3 bridge projects, the grade point for technical skill can be

$$T_s = 1+1+1/3-1 = 2.5$$

(n=3)

If the contractor has executed 4 bridge projects, the grade point for technical skill can be

$$T_s = 1+1+0.5 + 1/4-1 = 2.83$$

(n=4)

For considering  $T_s$ , the experience certificate issued to the contractor from not below the rank of Executive Engineer in the Government Department alone can be considered. If the experience certificate is a of a private project, the certificate issued from the consultant of that project can be considered.

$T_i$  - Grade point for infrastructure of specific nature obtainable by the relation

$$T_i = 1+\delta_{n2} + \sum_{x=3}^n \frac{1}{x-1}$$

Where  $\delta_{n2} = \text{def } \begin{cases} 1 & \text{if } n > 2 \\ 0 & \text{otherwise (} n < 2) \end{cases}$

e.g. If a contractor has 2 sets of machinery and plant put together required for the bridge project, the grade point will be 2 and if he has got 3 sets of machinery and plant, the grade point will be 2.5

(ii) Performance factor for Reliability of the contractor.

$$P_2 = 1 \dots \dots \dots (3.6.3.3)$$

Where  $P_2$  = Performance factor for reliability. If the contractor produces Income tax turnover and balance sheet for the last 3 years and the turnover of any year is not below

the PAC of the project for which bids are invited, the grade point that can be granted to him can be 1.

(iii) Performance factor for timely execution of projects:

$$P_3 = 2 - Y/X \dots\dots\dots (3.6.3.4)$$

Where  $P_3$  - Performance factor for timely execution of the project

Y - Time taken for completion of a project

X - Contract period

If number of projects considered are more than 1, the equation can be

$$P_3 = 2 - \frac{Y_1}{X_1} \dots\dots\dots (3.6.3.5)$$

$$P_3 = 2 - \frac{Y_2}{X_2} \text{ etc } \dots\dots\dots (3.6.3.6)$$

e.g.

Time of completion of a project - 10 months

Time taken for completion - 12 months

$$P_3 = 2 - \frac{Y}{X}$$

$$= 2 - \frac{12}{10} = 0.8$$

But, if the time taken for completion is 8 months

$$P_3 = 2 - \frac{Y}{X}$$

$$= 2 - \frac{8}{10} = 1.2$$

(iv) Performance factor for Quality execution of work:



$$P_4 = 1 \dots\dots\dots (3.6.3.7)$$

Where P<sub>4</sub> - Performance factor for Quality. If the contractor has got (i) an engineer/technical personnel with his establishment (ii) laboratory facilities for testing the quality of materials and for "cube tests" to determine the strength of concrete and (iii) a vibrator, the grade point that can be given to him can be 1 or if the Executive Engineer is satisfied with the quality execution of the projects by the contractor, on verification of the past performance from the history sheet kept at the Division office for each contractor, a grade point of 1 can be awarded.

(v) Performance factor for cost effectiveness;

$$P_5 = 1 \dots\dots\dots (3.6.3.8)$$

Where P<sub>5</sub> - Performance factor for cost effectiveness. If the contractor has executed more than 50% of the projects with the stipulated project cost or with a variation of ± 10% of the stipulated cost, a grade point of 1 can be awarded to him.

Maximum credit that can be awarded to a contractor

$$MC = \frac{W_1P_1 + W_2P_2 + W_3P_3 + W_4P_4 + W_5P_5}{n} \dots\dots\dots (3.6.3.9)$$

Where MC - Maximum Credit

W<sub>1</sub>, W<sub>2</sub>, W<sub>3</sub>, W<sub>4</sub>, W<sub>5</sub> - Percentage weightages allotted to each parameters for each project depending upon the requirement and situation. For instance, in certain project, maximum weightage will have to be granted for the timely execution of the project; in certain cases the maximum weightage will have to be assigned to quality execution etc.

n - number of parameters considered.

### **3.6.4 HOW TO ELIMINATE A LITIGANT CONTRACTORS**

If the history - sheet of a contractor reveals that he is frequent litigant and trouble some and the Engineer feels with his past experience that the contractor will not complete the project smoothly, it is better to eliminate him. For that the Executive Engineer has to record the reasons for the elimination in writing. If the tender is on a two cover system and if the technical bid indicates that the contractor has gone for litigation many a times causing trouble to the department and smooth execution of the project, the cover of price bid of that contractor need not be opened.

### **3.7 EXPLOITATION OF FAULTY PRICE VARIATION CLAUSE**

In a fixed price contract, the contractor is not entitled to claim any increase in the contract price for rises in the cost of materials, labour, transport etc. In some cases, price variation/price escalation clauses are not included in tender documents. This shall be paid, in case, it is stipulated by the contractor in his offer and if accepted by the employer. In certain such cases, it is seen that due to acceptance of a wrong clause on price variation/ escalation, the employer has to pay a huge amount to the contractor, which is not due to him. The contractor take advantage of this clause by slowing down the progress of the works to earn higher profit. Price variation/ price escalation is paid as per formula. Different formulae are adopted in different organisations. It may be due to ignorance of the particular aspect of the contract document such faulty formulae are accepted causing a heavy loss to the employer. So such clauses should not be incorporated by any of the party which may deteriorate the team spirit, reliability and co-operation in the whole game.

#### **3.7.1 INCLUSION OF PRICE VARIATION CLAUSE IN TENDER DOCUMENTS - A FAIR DEAL**

The price of materials, labour and fuel are increasing rapidly now-a-days. The price of cement has been increased four times in the year 1999 itself. Hefty price increase for diesel has been enforced recently by the Government of India. Mention must be made in this context that the practice of accepting the lowest priced tender by

government and public sector undertakings puts great pressure on the bidder, added to which are the evil systems of kick backs, commissions on every running bill and number of indirect favours sought by the officials in authority which throw a millstone around his neck. The contractor has little option but to overlook quality and make good these additional expenses.

In construction management, preparation of the contract documents and finalisation of the contract are the initial work. If there be any lapse and fault in this stage, then expeditious, trouble free execution and completion of the projects in time may be difficult. Hence in preparation of tender documents meticulous care ought to be taken for drawing up all clauses. It will be fair and justifiable to include the price variation/price escalation clause in the tender documents. It will be helpful to both the employer and the contractor. By providing a faultless clause, disputes are minimised, speedy completion of work are ensured and overall economy in project cost are achieved. The clauses are to be prepared in such a way that the contractor should not take advantage of this clause by encouraging to slow down the work. The formulae and the clauses should be such that contractors are encouraged to complete the works before schedule time to earn more profit. Different formulae used in Greater Cochin Development Authority (GCDA), Central Public Works Department (CPWD), Narmada Valley Development Authority (NVDA), Tamil Nadu Electricity Board (TNEB) and Asian Development Bank (ADB) have been dealt with in the Literature Survey. The formulae used in CPWD will be more appropriate to be included in the tender documents of State PWD, which are stated as follows.

(i) Escalation for Materials

$$VM = W \times \left( \frac{X}{100} \right) \times \left( \frac{MI - MI_o}{MI_o} \right) \dots\dots\dots (3.7.1)$$

Where VM - Variation in material cost i.e. increase or decrease in the amount in Rupees to be paid or recovered.

W - Cost of work done (85% of the cost of work as per the bills)

X - Component of Materials expressed as percentage of the total value of work  
 MI & MI<sub>o</sub> - All India wholesale Index all commodities for the period under reckoning as published by the Economic Advisor to Govt. of India, for the period under consideration and that valid at the time of receipt of tenders, respectively.

(ii) Escalation for Labour

$$V_L = W \times \left( \frac{Y}{100} \right) \times \left( \frac{LI - LI_o}{LI_o} \right) \dots\dots\dots (3.7.2)$$

Where V<sub>L</sub> – Variation in Labour cost. i.e. increase or decrease in the amount in Rupees to be paid or recovered.

W – Value of work done (85%)

Y – Component of Labour expressed as a percentage of the total value of the work.

LI – Minimum wage in Rupees of an unskilled adult male mazdoor, as fixed under any law, statutory rule or order as applicable on the last day of the quarter previous to the one during which the escalation is being paid.

LI<sub>o</sub>– Minimum daily wage in Rupees of an unskilled adult male mazdoor, as fixed under any law, statutory rule or order as on the last date on which tenders for the work were to be received.

(iii) Escalation for Fuel and lubricant

$$V_F = W \times \frac{Z}{100} \left( \frac{FI - FI_o}{FI_o} \right) \dots\dots\dots (3.7.3)$$

Where V<sub>F</sub> – Variation and Fuel and lubricant cost i.e. increase or decrease in the amount in Rupees to be paid or recovered.

W – Value of work done 85%)

Z – Component Fuel and lubricant (P.O.L.) expressed as a percentage of the total value of work

FI & FI<sub>0</sub> – Average index number of wholesale price for group (fuel, power light and lubricants) as published weekly by the Economic Advisor to Govt. of India, Ministry of Industry & Commerce for the period under reckoning and that valid at the time of receipt of tenders, respectively.

The escalation shall be worked out based on the following guidelines.

1. As per the contract clause on escalation of CPWD, escalation shall be payable for a work for which the stipulated period of completion is 6 months or less. But the clause shall be modified in such a way that price variation clause are not applicable for contract where time period is 12 months or less. Also not payable for the quantity of work done during first 12 months or on that portion of works which contractor has to execute in the first 12 months. Escalation clauses are not to be applicable where value of work is less than Rs. 50 lakhs.

2. The components of materials, labour, P.O.L. etc shall be predetermined for every work and incorporated in the conditions of contract. A general guide for the fixation of percentage of the various components of works can be as follows.

- (a) Fixed cost            15%
- (b) Material cost        0% to 45%
- (c) Labour cost          30% to 80%
- (d) Fuel and lubricant 5% to 10%

3. Price escalation clause is not applicable if the work is not completed in the stipulated time period or authorised extension of time.

4. In case, the progress of the works are behind the scheduled programme, then the escalation rate will be considered based on price index of the period when the work on items of works are programmed to be completed.
5. The compensation for escalation shall be worked out at quarterly intervals and shall be with respect to the cost of work done during the three calendar months of said quarter.

## **CHAPTER - 4**

### **EFFECTIVE CONSTRUCTION MANAGEMENT - SOME TYPICAL CASE STUDIES**

#### **4.A. KERALA LEGISLATURE COMPLEX**

##### **4 A. 1 INTRODUCTION**

In the earlier periods of the implementation phase of Kerala Legislature Complex, the lethargic attitude of the implementing agency and the inadequate annual budget allocation of fund have resulted poor progress. But during the last two years of the project, attitude of the Government was changed due to the commitment to complete and inaugurate the project to commemorate the Golden Jubilee Celebration of the Independence. Then, there was no dearth of fund. A study of the project in detail will enlighten us the impact of attitudinal change and the cash flow in the effectiveness of construction management.

Kerala Legislature Complex is a State Government sponsored project with fund from state exchequer. The complex is one of the most modern legislature complexes in India. It is situated in a sprawling 11 acre campus at Thiruvananthapuram, capital city of the State of Kerala. The then President of India laid the foundation stone for the new Legislature Complex on June 4, 1979 in the presence of the then Chief Minister, and Speaker. The project was implemented in two phases.

##### **4 A.2 PHASE - 1**

The first phase of the project comprising the Administrative Block, Plant Room (Substation of 2 x 1000 KVA capacity Diesel generators), Residential Quarters for the Speaker, Deputy Speaker and the Legislative Secretary was initiated in 1980. The then Lok Sabha Speaker inaugurated the administrative block on May 21, 1985 in the presence of the then Speaker and the Leader of the Opposition,

### **4A. 3 THE ADMINISTRATIVE BLOCK - SALIENT FEATURES**

- Area: 19180 Sq. m across 5 blocks
- This block house

The Legislative Secretariat

The Speaker's Office

12 Committee Rooms

3 Conference Halls

Banquet Hall

3 Dining Halls

Auditorium

Recreation Club

9 offices of the Chairmen of committee

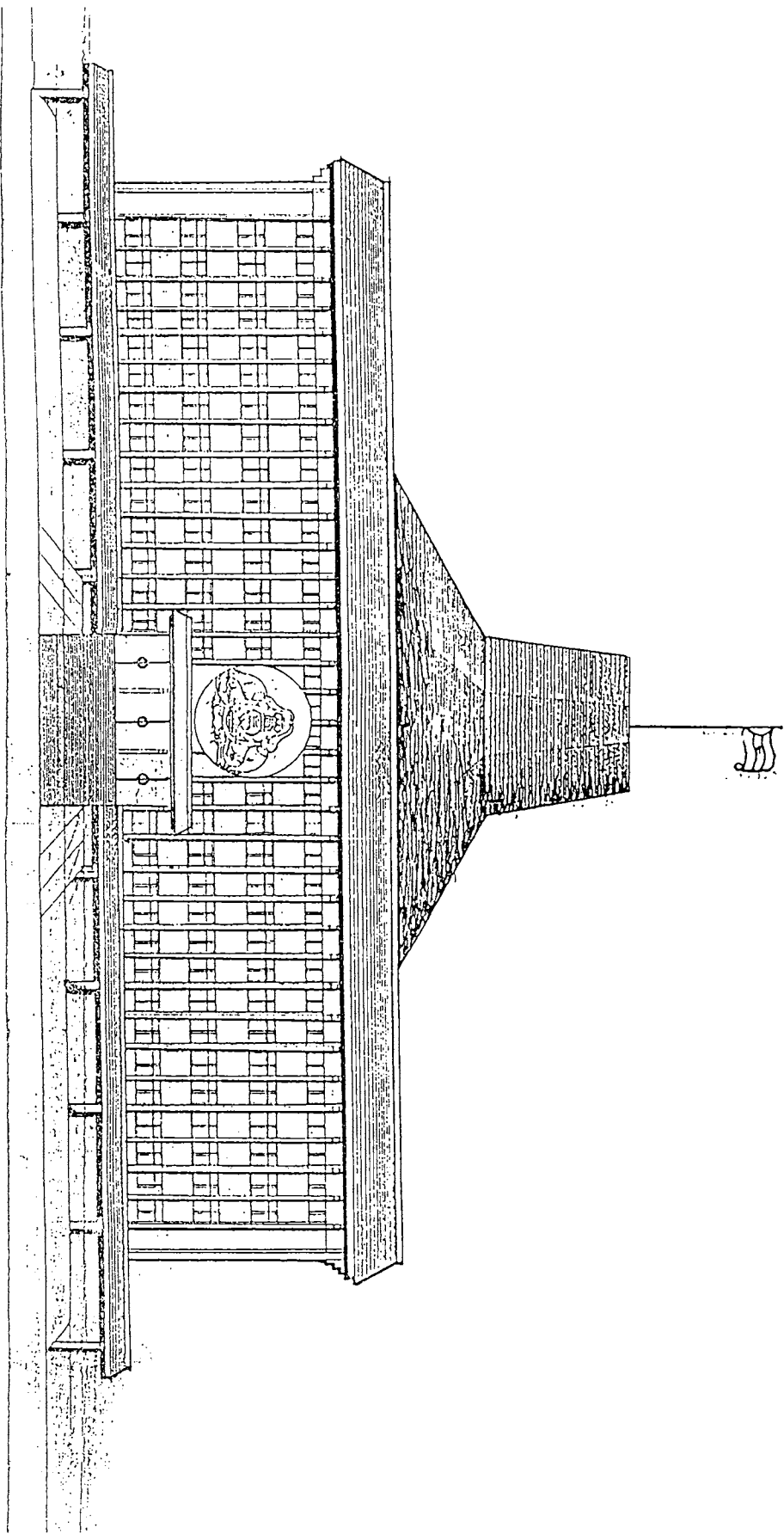
Library in 3 floors

The first phase of the project was completed in 1986 and the total cost for the first phase worked out to be Rs.13.55 crores.

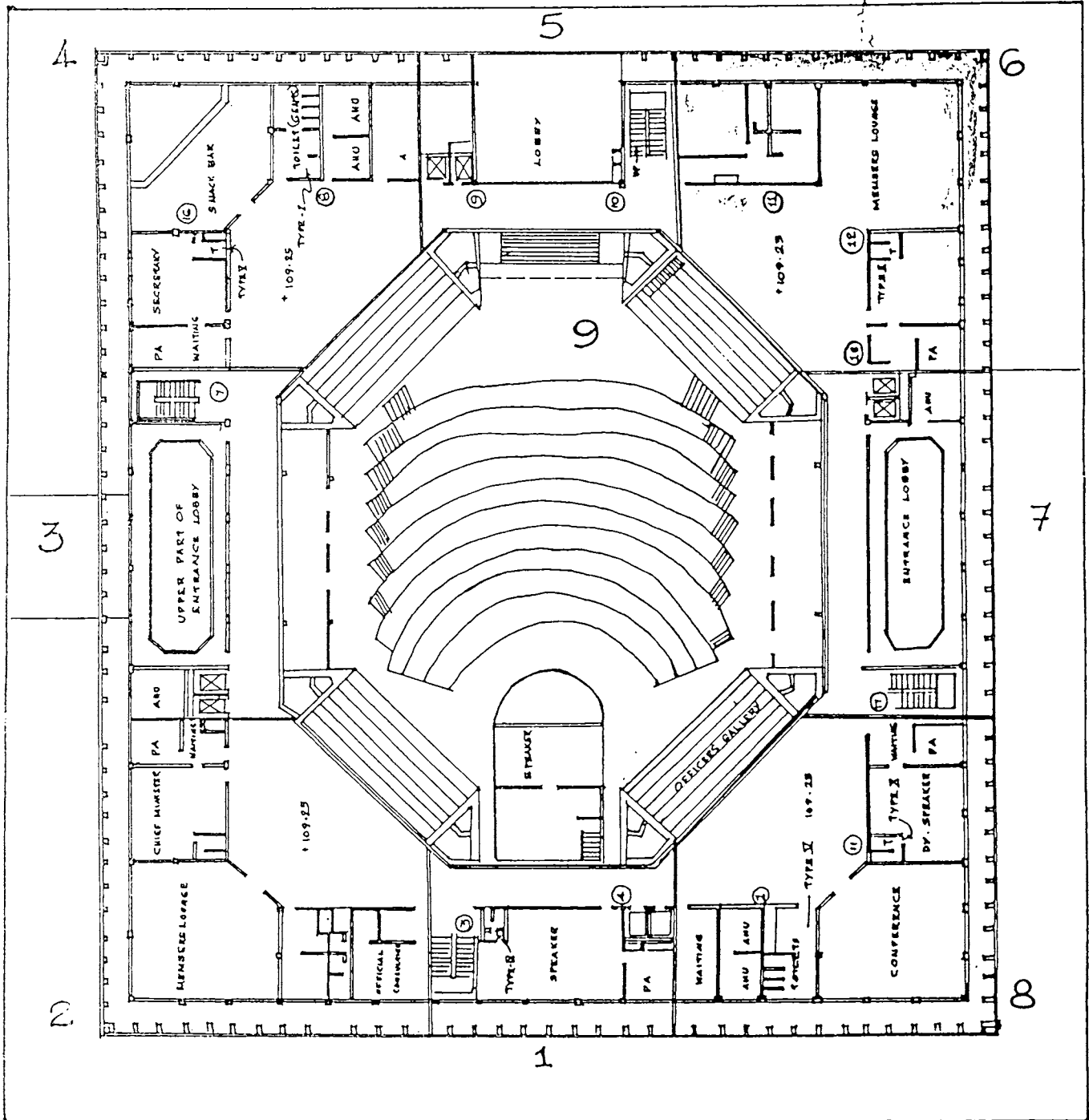
### **4A. 4 PHASE - II**

The second phase consisted of the 8 storeyed Legislative Assembly Building. The work was formally commenced when the then Speaker of Kerala Legislature Assembly laid the foundation stone on 11-08-1986. The elevation, plan and cross section are shown in figures 4A.4.1, 4A.4.2 and 4A.4.3.





front elevation.  
FIG. 44-1 LEGISLATIVE ASSEMBLY BUILDING



PLAN  
 Fig 4A:42 LEGISLATIVE ASSEMBLY BUILDING

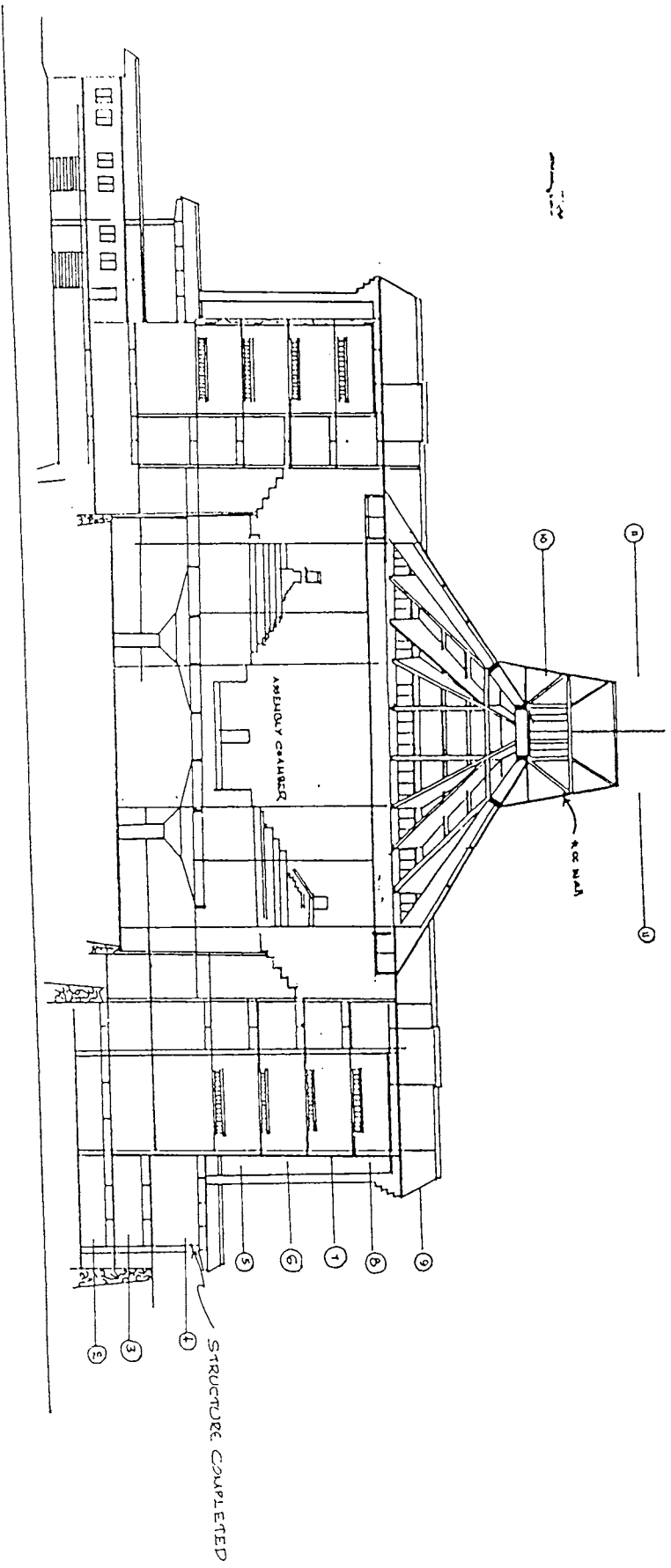


Fig. 44-3 LEGISLATIVE ASSEMBLY BUILDING

#### 4 A. 5 CONSTRUCTION OF LEGISLATIVE ASSEMBLY BUILDING

Salient aspects of civil works are as in Table 4.1.

**Table 4.1 Salient Aspects of Legislative Assembly Building**

1. Date of Commencement	23-07-1986
2. Date of completion as per agreement	
(a) Date of completion original	22-07-1990
(b)         "             extended (i)	1-8-1993
(c)         "             "         (ii)	31-12-1995
(d) Date of commissioning	22-05-1998
3. Estimated P.A.C.	6.99 crores
4. Contract P.A.C.	9.71 crores
5. Tender excess (original)	56% above 1982 Schedule of rates followed by escalation
6. Rate revision from 1-8-1993	40% above 1992 Schedule of rates stripping the escalation clause.
7. Rate revision requested from 2/94	85% above 1992 Schedule of rates
8. Cement used for the work	22121 tonnes
9. Steel used for the work	6477 tonnes
10. Cost of civil works	22.5 crores
11. Total cost of construction of the Assembly Building (including all services)	50.45 crores

The total plinth area is 42,588m<sup>2</sup>, the details of which are given in Table 4.2

**Table 4.2 Plinth Area Details**

<b>Level</b>	<b>Height Metres</b>	<b>Plinth Area Sq. Mts</b>	<b>Accommodation Provided</b>
1-1 92.15	4.35	897.00	Parking
2-2 96.50	6.70	3047.00	Press, Lobby etc.
"	3.30	2867.00	Press, stores, office etc
3-3 99.80	4.05	4716.00	Office and stores
101.15	8.10	1035.00	Members' lounge (22.5 Ms plan)
"	8.10	338.00	Part of members' lounge
"	2.70	233.00	Part of lounge
4-4 103.2-103.85	5.40	5812.00	Post office, bank, reservation, telephone exchange, canteens, staff room, lobby etc
5-5 109.25	5.40	2500.00	Parking
"	20.00 (av.)	1433.00	Assembly chamber (37 m span)
"	4.20	4815.00	Speaker, Dy. Speaker, Chief Minister, Secretary, Canteen, Medical aid, Security staff, Officials, consulting, galleries etc.
6-6 113.45	4.20	4818.00	Minister's room (committee room)
7-7 117.65	4.20	4728.00	Minister's room (including galleries)
"	7.00	90.00	Committee hall
8-8 121.85	4.20	4728.00	Minister's room (including galleries)
9-9 126.05	4.20	486.00	Lift machine rooms and staircases
126.05	--	--	Roof (canopy) floor level.
129.75	--	--	Top of parapet level
148.05	--	--	Canopy top level
	55.09	--	Total height from ground floor to canopy top.

The Legislative Assembly Building has been designed as a portal frame structure with the central assembly hall. Octagonal in shape, the central assembly hall is surrounded by eight peripheral blocks.

- Area: 42588 sq.m. across 8 floors. 3 below and 5 above the ground.
- The block houses

The Assembly Hall.

Area 1340 sq. m.

Seating capacity 186.

(Provision to seat 250)

Seating capacity of the five galleries for reporters, VIP's and officers : 1438.

Member's lounge Area : 1375 sq. m.

Seating capacity: 1000.

Facilities around the lounge:

Post office, telephone exchange, staff room, bank, press conference hall, reservation counter, cafeteria.

Lobby.

Hall for public exhibitions .

VIP rooms for Speaker, Deputy Speaker, Chief Minister & Leader of Opposition, Ministers, Government Chief Whip and Opposition Chief Whip.

28 rooms for Ministers.

There are arrangements for simultaneous translation of speeches into four languages and electronic voting. There are also other facilities such as an electronic press, emergency announcement system, self activating fire alarm system and a sprinkler system. Three of the five-floor structure are under the ground level and the assembly chamber is four-floor high.

Besides conference halls for holding committee meetings, there are also a banquet hall and separate rooms which could be used by committee chairpersons and Legislature parties. The three conference halls furnished with every modern convention facility will be the ideal venues for national and international meets in the

state. There are separate facilities to seat journalists and visitors. The Legislature Library would be spread over three floors and efforts are on to provide latest communication arrangements including Internet accessibility. There would also be a special library-cum-reference facility close to the Assembly Chamber. The magnificent central assembly hall is with a height of 29 metres from the floor level. With its lowering dome, exquisitely carved galleries, ornate teak panellings and ceilings combined with the modern acoustics treatment and state of the art sound system, the hall is a beautiful blend of classical grandeur and modernity. The entire wood work that adorns the assembly hall is an excellent reflection of traditional Kerala Architecture. Some of the carvings exhibit designs that require exceptional skill. In fact, it took 2,00,000 carpenter hours to complete the wood work in the assembly hall alone. The traditional charm of the hall is heightened by the octagonal skylight which floods the hall with natural light. The ceremonial gateway of the entrance in the traditional Kerala Style architecture, is as imposing as the structure which it opens its doors to. There are three other entrances also.

**Common facilities:**

- Central air conditioning in all important areas
- Elevators: 8 nos
- Acoustic and sound reinforcement systems
- Automatic fire alarm and sprinkler system
- CC TV surveillance system
- Covered car park

This integral self sufficient complex affords all the facilities required for the proper functioning of the legislature.

**Other important factors of the Legislative Complex:**

Total land area	11 acres (4.455 hectares)
Total built up space	61760 sq. m
Total financial outlay :	Rs. 68 crores

**Details of cost:**

Phase I	1355 lakhs
Phase II Civil works	2250 "
Electrification	320 "
Water supply and sanitary	
Works	100 "
Air conditioning	500 "
Interior Decoration and	
Acoustic arrangements	550 "
Aluminium doors, windows and grills	180 "
Approach road, internal	
Road and drain	80 "
Furniture	425 "
Fire alarm and sprinkler system	60 "
Telephone system	90 "
Electronic voting, sound system	
and CCTV	310 "
Compound wall	200 "
Landscaping and yard lighting	120 "
Emblem	22 "
Lifts	100 "
Kitchen equipment and Dump waiter	18 "
Sump, Tube well and W.S.	10 "
Consultancy services	60 "
Contingency provision	<u>50 "</u>
Total	<u>6800 lakhs</u>

The total expenditure incurred so far 63 crore

**\* Consultants:**

1. Architectural Design: Sri. M. Ramaswamy Iyer }  
Sri. P.V. Thomas Paniker } Chief Architects



2. Structural Design:

Sri. V. Sankara Iyer - Chief Engineer

Sri. V. Kulathu Iyer - Director (Design)

Sri. S. Ravikumaran Nair - Design Engineer

3. Interior Decoration M/s Rakesh Sahani Associates

4 Electrical, Air-conditioning &  
Plumbing, Fire fighting : M/s Maneck N. Dastur

5. Acoustics Surya & Surya

6. Landscaping Sri. Viswanathan

#### **4A.6 EXECUTION OF THE WORK OF LEGISLATURE COMPLEX THROUGH KERALA PUBLIC WORKS DEPARTMENT**

The P.W.D is in charge of the design, construction and maintenance of all public works undertaken by the State Government. So the design and implementation of the Legislature complex was carried out through the Kerala Public Works Department.

#### **4A.7 ORGANIZATIONAL SET UP OF THE KERALA P.W.D**

The entire work of the Legislature complex was carried out under the administrative control of a Chief Engineer, posted exclusively for this project. There is an Architectural wing in the office of the Chief Engineer consisting of a Chief Architect and Assistant Architect etc. The assistance of this wing was made available for the architectural designs of the complex. There was one Superintending Engineer under the Chief Engineer. Under the S.E., there is an Executive Engineer in charge of a division. The division is divided into 2 sub divisions in charge of Assistant Executive Engineers and the sub divisions in turn are divided into Section under the charge of Assistant Engineers. As indicated above the lowest executive unit of the organizational set up is the section whose jurisdiction was functional. The Assistant Engineer was in charge of specific works or specific functions. For carrying out executive and supervisory functions, each section was having two overseers. In addition to executive

functions, the Assistant Engineer has to maintain the initial records of all transactions relating to works, supplies and services under his charge and render accounts to his superior authority as prescribed in the rules.

The works of two sections is controlled by a sub division under the charge of an Assistant Executive Engineer, who generally is vested with powers, within certain limits, to sanction estimates, enter into contracts and make payments. The Assistant Executive Engineer has also to guide subordinate offices in the preparation of estimates and take all steps necessary to examine that works under charge of the sub division are properly executed. He has to maintain and render accounts as prescribed in the rules or orders in force.

The main executive unit of the department is the division in charge of an Executive Engineer, who controls the works of all the sub divisions under his jurisdiction. The Executive Engineer is responsible for the proper execution of all works in his division and also in guiding and controlling the subordinate technical officers in regard to investigation, design, estimates etc. He has also powers of sanctioning estimates and entering into contracts within certain limits. As the disbursing officer of the department all payments for works, supplies and services are made in the division and sub divisions under him and the Executive Engineer has to render the prescribed accounts to the Chief Engineer. The division office has two branches the Technical (Drawing branch) and Accounts branch. The technical branch is under a Technical Assistant in the cadre of Assistant Executive Engineer with the necessary complement of technical subordinate staff such as Draughtsman, Head Draftsman etc. The accounts branch is under the overall control of a Divisional Accountant with necessary ministerial staff. The Superintending Engineer has also powers of sanctioning estimates and entering into contracts within the limits prescribed in the delegation of powers. There will be technical branch and administrative branches with suitable officers and staff. The Chief Engineer is the administrative and a professional head of the branch of the department he is in control of and is responsible for its efficient working. He is also the professional advisor to Government on all matters relating to his branch. The office organisation will include a

design and technical wing, administrative wing and a financial wing with necessary officers and staff in each branch.

6247 (5483)  
1730

#### **4A. 8 KERALA STATE CONSTRUCTION CORPORATION LTD - THE MAIN CONTRACTORS OF THE LEGISLATIVE ASSEMBLY BUILDING**

Kerala State Construction Corporation Ltd. is an undertaking of Government of Kerala having its Registered office at Thycadu, Trivandrum - 14 and Administrative office at Banerji Road, Cochin - 18. The company is participating in tenders floated by various agencies for construction of buildings, consultancy service etc, and have secured a number of works in these competitions. The company enjoy 10% price preference for tendered works of PWD except NH.

#### **4A. 9 THE CAPITAL**

The authorised capital of the company is Rs. 200 lakhs. The paid up capital is only Rs. 87.50 lakhs.

##### **1. LOANS**

The assistance provided by Government of Kerala is 205 lakhs.

##### **2. MOBILISATION ADVANCE**

Another source of working capital is the Mobilisation advance from clients.

##### **3. CASH CREDIT**

KSCC enjoy a cash credit facility of Rs. 75 lakhs with State Bank of Travancore.

#### **4A. 10 THE WORKS**

The work of construction of the Kerala State Assembly Building was entrusted to Kerala State Construction Corporation by the Government of Kerala Vide G.O. (MS) 76/86 PW & T Dated 18-7-1986 and the agreement was executed on 31-7-1986. The

work was formally commenced when the then Hon'ble Speaker, Kerala Legislature Assembly laid the foundation stone on 11-8-1986. The agreed time of completion was 4 years. The agreed PAC of the original contract was 9.71 crores. KSCC started the work in right earnest on a CPM charted out planned programme. The work did not progress according to the planned schedule due to the delay in getting funds. They had prepared revised PERT for completing the civil works by December 1995 in consultation with Chief Engineer, Legislature Complex. Due to the paucity of funds, works could not be completed as scheduled. Government have sanctioned a rate revision at 40% above 1992 Schedule of Rates after stopping the payment as per the escalation clause (24%) originally included in the agreement.

The following are the works done by KSCC in the Legislature Complex.

1. Civil structural works of Assembly Building	- 26.62 crores
2. Water supply and sanitary works	- 1.00 crore
3. Interior decoration and acoustic arrangement	- 5.50 crores
4. Emblem	- 0.22 crore
5. Approach road, internal road and drain	- 0.80 crore
Total	- <u>34.14 crores</u>

#### **4A.11 MONITORING OF THE WORK OF ASSEMBLY BUILDING**

The progress of work was being monitored by high-level committees constituted from time to time. The last high-level committee has the Chief Minister, the Finance Minister, the Education and Public Works Minister, the Leader of the Opposition, and the former Speaker. A Review Committee comprising the Speaker and the PWD Minister was monitoring the progress of work every month and giving instructions whenever necessary. During the final stages of construction, the Review Committee used to meet almost on a daily basis. The extent of work done during the last two years could be gauged from the fact that construction work costing about Rs 16 crores was undertaken during this period. The PWD Secretary, the Chief Engineer (Legislature Complex), the Kerala State Construction Corporation Managing Director,

other officers, technical experts and workers deserve special praise. A statement of accounts in respect of each bill is as follows.

#### 4A. 12 STATEMENT OF ACCOUNTS OF BILLS

The accounts of various bills in respect of Legislature Assembly Building is furnished in Statement No. III

#### Statement No. III Accounts of Bills - Legislative Assembly Building

Part Bill			Bill Amount			
Year	No. CC & Part	Date	Claimed Rs.	Admitted	Remarks	
1986-'87	Mobilisation	Advance	20,00000/-	20,00000/-		
	do		5,00000/-	5,00000/-		
	I	20-01-'87	15,74,737.62	12,26,123		
	II	28-02-'87	18,09,456.79	20,07,519		
	<u>Price Escalation</u>					
		31-12-'86	4,660.60	4,660.60		
		"	<u>66,929.41</u>	<u>66,929.41</u>		
		<u>5955784.42</u>	<u>5805232.01</u>			
1987-'88	III	16-06-'87	31,00,626.51	27,43,541.00		
	IV	5-11-'87	26,85,967.53	31,28,433.00		
	<u>Price Escalation</u>					
		19-11-'87	82,148.00	82,148.00		
		11-02-'88	1,32,975.45	1,32,975.45		
	"	<u>82,126.00</u>				
		<u>60,83,843.49</u>	<u>60,87,097.45</u>			
1988-'89	V	27-04-'88	17,81,730.59	3,21,405.00		
	VI	31-08-'88	11,45,689.00	13,00,697.00		
	VII	9-12-'88	11,44,041.00	12,09,724.00		
	VIII	23-02-'89	1,05,209.00	31,18,967.00	Including Secured Advance	

		<u>Price Escalation</u>		
		31-12-'88	1,28,826.00	
		"	5,731.00	
		15-2-'89	32,359.00	
		27-2-'89	<u>1,39,410.00</u>	
			<u>44,82,995.59</u>	<u>59,50,793.00</u>
1989-'90	IX	24-8-'89	45,84,736.12	30,50,153.00
	X	4-12-'89	27,12,278.95	27,83,094.00
		<u>Price Escalation</u>		
		19-9-'89	1,66,995.00	
		20-10-'89	92,329.00	
		1-1-'90	<u>3,39,145.00</u>	
			<u>78,95,484.07</u>	<u>58,33,247.00</u>
1990-'91	XI	2-4-90	22,78,919.72	22,55,614.00
	XII	27-6-90	17,69,650.99	17,69,097.00
	XIII	13-10-90	13,87,306.59	13,55,061.00
	XIV	28-12-90	18,24,358.30	18,39,172.00
	XV	22-3-91	4,58,196.64	4,35,938.00
	Work			14,00,000.00
	Advance			
		<u>Price Escalation</u>		
		1-6-90	2,40,828.00	
		22-9-90	3,34,397.00	
		19-12-91	<u>3,40,474.00</u>	
			<u>70,41,431.24</u>	<u>90,54,882.00</u>
1991-'92	XVI	10-6-91	39,87,348.57	39,29,319.00
	XVII	7-10-91	19,15,637.53	19,13,381.00
	XVIII	2-12-91	14,90,202.81	14,60,396.00
	XIX	29-1-92	14,26,705.21	14,18,461.00
	XX	23-3-92	22,29,158.64	21,95,089.00
		<u>Price Escalation</u>		
		28-5-91	3,05,795.00	

	"		2,35,537.00	
	10-10-91		96,636.00	
	14-12-91		<u>9,60,118.00</u>	
			<u>1,26,47,138.76</u>	<u>1,09,16,646.00</u>
1993-'94	XXV	17-6-'93	18,75,767.76	17,18,440.00
	XXVI	27-9-93	10,96,370.37	10,96,386.00
	<u>Advance Price Escalation</u>			25,00,000.00
	<u>Price Escalation</u>			
		10-9-93	7,26,449.00	
		"	4,66,577.00	
		23-2-94	4,54,442.00	
	XVII	9-12-93	16,03,385.00	16,05,009.00
	Work			50,00,000.00
	Advance			
	"			50,00,000.00
	XXVIII		19,55,449.00	19,55,449.00
	<u>Advance Price Escalation</u>			30,00,000.00
	XXIX & XXX	1-11-94	23,67,144.83	
		"	63,57,487.14	87,39,304.00
	XXXI	31-12-94	12,70,233.00	1,06,79,917.00
	Work advance			<u>1,23,64,000.00</u>
			<u>1,81,73,305.10</u>	<u>5,36,58,505.00</u>
1995-96	XXXII	29-3-95	30,24,452.00	36,61,606.00
	XXXIII	27-7-95	1,09,97,181.10	83,07,857.00
	Rate revision w.e.f. 1-11-94 (for the above 2 bills)		35,14,229.93	
	XXXIV	23-8-95	42,51,824.00	20,60,000.00
	XXXV	17-10-95	23,13,233.16	7,00,000.00
	<u>Secured advance</u>			
		24-11-95		1,00,00,000.00

		19-12-95		1,00,00,000.00	
		22-1-96		1,00,00,000.00	
	<u>XXXVI</u>	19-3-96	<u>2,71,14,692.00</u>	<u>1,27,02,662.00</u>	
			<u>5,12,15,612.09</u>	<u>4,47,29,463.00</u>	
1996-97	XXXVII	20-9-96	4,99,64,042.00	69,97,229.00	
	XXXVIII	18-2-97	<u>5,67,42,880.00</u>	<u>2,64,36,374.00</u>	
			<u>10,67,06,922.00</u>	<u>3,34,33,603.00</u>	
1997-98	XXXIX	30-6-97	<u>4,59,54,140.00</u>	<u>1,01,07,958.00</u>	
		Total	<u>26,61,56,656.80</u>	<u>18,55,77,426.50</u>	

The statement shows that within 12 years the value of the civil work done for the construction of the Assembly Building is 26.62 crores. Out of this the work to the tune of Rs. 16.00 crores has been done during the last two years.

#### **4A. 13 COMPOSITION OF KSCC**

The present composition of the company is as under.

##### **Board of Directors:**

Secretary, P.W.D. - Chairman

Managing Director

A Government Secretary

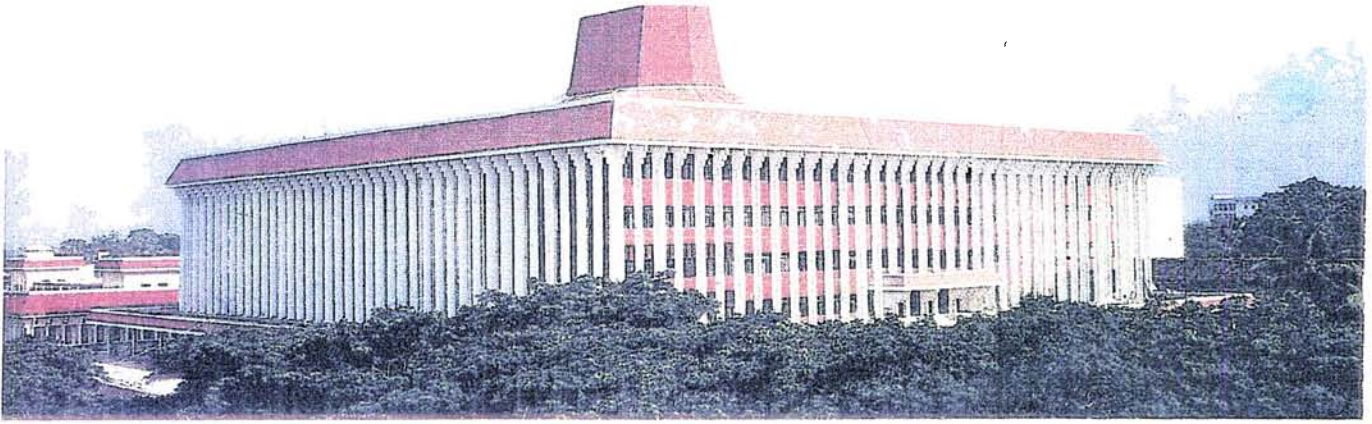
Chief Engineer, Buildings and Local Works, PWD

Additional Secretary, Finance

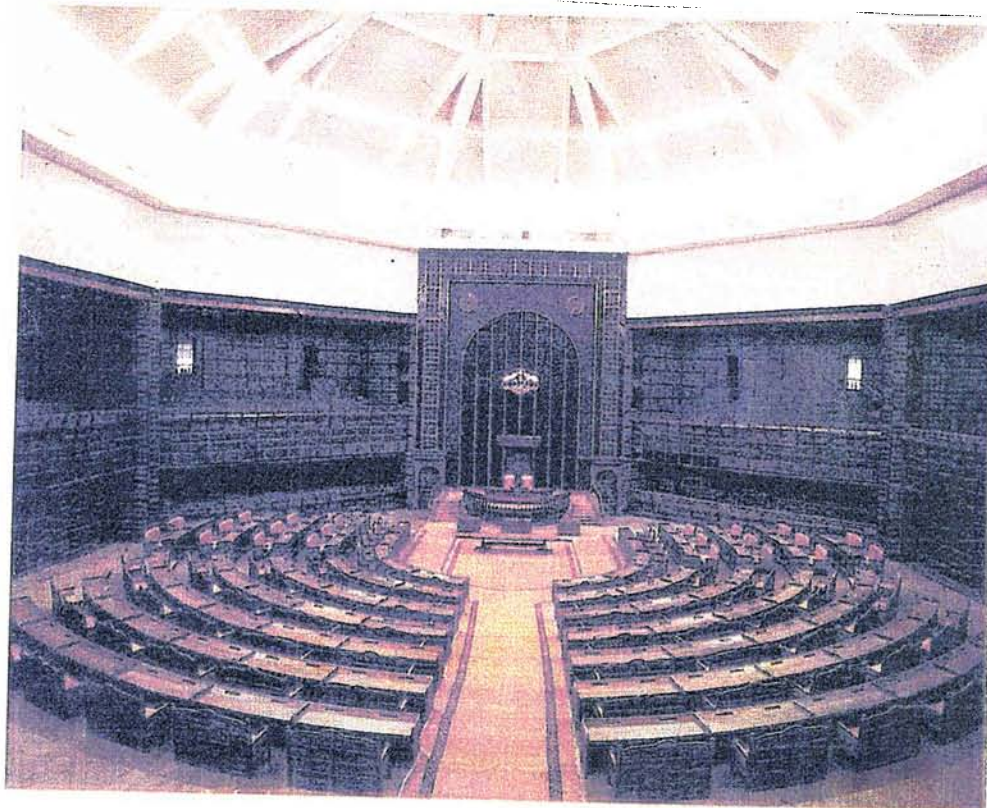
Chief Engineer, PWD

A Municipal Councilor, Muvattupuzaha





**KERALA LEGISLATIVE ASSEMBLY BUILDING  
AT THIRUVANANTHAPURAM**



**A VIEW OF THE MAGNIFICENT CENTRAL ASSEMBLY HALL OF THE  
LEGISLATIVE ASSEMBLY BUILDING**

**Officers:**

A Company Secretary and a Finance Manager to assist the Managing Director in administration

The present staff strength 251 is as follows:

	Technical	Non Technical
Regular	11	135
On Deputation	11	1
On contract & Daily wages	<u>16</u>	<u>77</u>
Total	<u>38</u>	<u>213</u>

**4A. 14 IMPLEMENTATION EFFECTIVENESS IN THE PROJECT OF KERALA LEGISLATURE COMPLEX**

It is universally accepted that effective implementation of projects is mainly dependent on the Project - Team especially on the leadership style of the project leader. A study was conducted to find out the specific traits of the Project Leader, system of approach, methodologies etc. adopted for better performance effectiveness in the construction of Legislative Assembly Building. The primary data for the study was obtained by conducting interviews with the field technical personnel, the top officials of PWD and Kerala State Construction Corporation, worked for the project. The data thus collected were analysed to arrive at certain findings.

**4A. 15 PERCEPTIONS BY THE SUBORDINATES**

In an analysis of the project, which picked up great momentum, once the leadership or management changed, it will be beneficial in the context of the present work, to identify the reasons which helped speedy completion of the work from the perception of the subordinate engineers involved in the project.

1. Change of project leader indicated time-bound nature of the scheme.
2. Project team was not optimistic on the completion of the project even with the new project leader during the last stage of change.
3. Sense of urgency was lacking among the team members in the initial stages
4. Sense of urgency was felt only in planning but not in implementation.
5. Emphasis on time factor by new project leader.
6. Old leaders never showed a feeling of conviction on the possibility of accomplishing target in time but the new leader showed that conviction.
7. Perception of the new leader as a person in the stages:
  - a) Conviction
  - b) Clarity of objectives and time factor
  - c) Clear communication at all levels.
8. Change over period and the immediate impact:
  1. became aware of the need for completing the project within time scheduled
  2. neither optimistic nor enthusiastic
9. New leader - a change is felt
  - i. daily meeting for review and planning
  - ii. leader acted as a facilitator
  - iii. clear communication on all aspects
  - iv. timely decision
  - v. feeling that the leader enjoyed the support of higher level officials
  - vi. feeling that leader will support the subordinates even if they go wrong in genuine cases which was missing in the early phase of the previous leaders.
  - vii. Feeling that new leader was taking strong action against indiscipline by his power and influence.
10. Immediate subordinates felt enthusiasm than fear
11. An awareness among team members that the new leader is conversant with the project details.
12. New leader acted as quick problem solver and decision maker.
13. New leader was physically present as and when required.

14. New leader supported and encouraged the member to take independent decisions.
15. Enthusiasm was maintained without ups and downs.
16. No observed cliques (a gap in the initial stages but cohesive team after some time)
17. Office people were not as enthusiastic as the project team but afraid of the power and influence of the new leader.
18. Hierarchy maintained and not short circuited
19. Environment - no change in the contract labour, police interference whenever required enabled to maintain the tempo of work.
20. Convening the meetings of local leaders, officers and other departmental officers etc. had positive effect.
21. Sub contractors looked at him with a frown of disapproval first, later accepted.
22. Sub contractors feeling of power and influence at higher levels dwindled and they became cooperative.
23. Empowered committee was perceived as very powerful
24. Fear of the sub contractors that they might be put into disadvantages if they did not cooperate.
25. Group members felt relaxed during the last stage with a feeling that they had achieved the result.
26. Result achieved without increase in cost.
27. Personal style of the leader was a predominant factor.
28. Frequent Planning and review meetings were very helpful.
29. Integrity of new project leader (members did not perceive any motive in him except completion of work) was a major factor for completion of work.
30. New project leader was not earnestly willing to listen but not willing to abdicate responsibility - a decision only after thorough discussion on all aspects - if the decision of the leader was different he explains with facts and figures and convinces the other members.
31. Initial feeling of inability to complete the work in time within the normal administrative frame work.

32. Contractors were enthusiastic because of the prompt payment and supply of materials in time.
33. Follow up action based on review and re-planning sessions by the officers forced sub contractors to complete the work in time.
34. Local sub contractors who could not get work in the project supported agitations by workers.
35. Problems of labour solved through conferences
36. Quality of work did not suffer by speed
37. High morale and enthusiasm without expecting additional reward.
38. High team spirit at all levels
39. Acceptance of the project leader
40. Most of the decisions were quick without prolonged debate
41. There was resistance to the daily meeting in the initial stages but became a pleasure in due course.
42. The delay in getting funds did not affect tempo of work very much under the new leader. But non-inclusion of sufficient fund in the budget during early stages affected the tempo of work (under former leaders).
43. Changed conditions created a confidence that the target could be achieved within the stipulated period under new leader and this action as a catalyst.
44. Perception of new leader-competent and committed no fear but respect members gained additional confidence by the style of the leader.
45. Subordinates became confident that they can now take decisions for the project leader will always support them for such independent decisions.
46. Interestingly all the subordinate engineers express their willingness to continue as a member of the team if the same conditions and climate continue.

Based on the above analyses and perceptions, discussions will be initiated in the 5<sup>th</sup> chapter.

## **4B. INTERNATIONAL STADIUM AT COCHIN-A SPORTS PROJECT OF GREATER COCHIN DEVELOPMENT AUTHORITY**

### **4B.1. INTRODUCTION**

The construction of International Stadium within the time is a shining example of effective Construction Management. A detailed note on the back ground of the work and the organisational set up of the implementing agency will be helpful to analyse the work better. A critical study of this project will bring out certain important aspects of construction management with a view to improve efficiency and economy in construction.

The Greater Cochin Development Authority (GCDA) was constituted by the government of Kerala during the year 1976 for the sole purpose of attending to the planned development and the social and economic upliftment of the areas brought under its jurisdiction. The Authority was constituted under Section 53 of the Town Planning Act vide Government Order (Ms) No.19/76/LA &SWD dated 23.1.1976.

The area of Jurisdiction of this Development Authority consists of the areas covered by Cochin city Corporation, 7 Municipalities and 32 Panchayats in and around Cochin city, the headquarters of the revenue district of Ernakulam. The total area of jurisdiction of this Authority comes to 732 sq. kms, consisting mainly of urban areas. This Authority has its headquarters at Kadavanthra, Cochin.

The port city of Cochin with a population of over 10 lakhs within the Cochin City Corporation limits itself, is the commercial capital of the state. Development of Cochin had been on a very fast pace during the past few years, resulting in open space already available falling too short of laid down standards which has now fallen to lesser than 0.70% of total land area. It is estimated that the population within the area covered under the jurisdiction of GCDA will cross 20 lakhs by 2000 AD. The city of Cochin has practically not much of open space and consequently there are no sports

facilities available in the area. The sports loving people of Cochin had always been clamouring for major tournaments to be held in the city.

International matches, mainly football, had been held in Cochin city on a number of earlier occasions despite the constraint of lack of an organized stadium. The main event that had been consistently keeping the citizens of Cochin alive to the demand for a regular stadium has been the major football tournaments being conducted here. International football events have been held in the Government Maharaja's College Ground from as far back as 1957. All these tournaments were conducted by erecting improvised wooden galleries in this college playground. Main international events that have been held here recently are Jawaharlal Nehru gold cup International football Tournaments during the years 1983 and 1985. The need for seating arrangements for spectators for such international events can be seen from the fact that organizers of 1985 Jawaharlal Nehru gold cup International Football Tournament had constructed the highest wooden improvised galleries to a height of 21 meters which has now found an entry in the pages of Guinness Book of world Records. The demand for the regular stadium had been on the increase from the sports loving public of Cochin for a few years and the same has been brought to the notice of the Government of Kerala in the state Legislature on many occasions. The 49<sup>th</sup> Santhosh Trophy Football tournaments was conducted at Cochin during 1993 by arranging temporary wooden galleries. Then Honorable Chief Minister of Kerala, who inaugurated the tournament in his opening speech promised the sports loving people of Cochin that it will be the endeavor of Government of Kerala to construct a stadium of international standards at Cochin as early as possible since the whole state had no such stadium at present. That was in the year 1992. Consequent to this announcement, the GCDA was directed to take up construction of an International stadium of suitable capacity so that the next Jawaharlal Nehru Gold Cup. International Football Tournaments in 1995 that may be allotted to Kerala can be hosted at Cochin in the proposed stadium.

#### **4B.2 COMMENCEMENT**

GCDA was directed to take up such a big project since the Authority alone was in a position to raise resources and procure suitable land within Cochin City

Corporation area. In accordance with this decision, it was directed by the government that 20 acres of prime land within the Central area of Cochin City, under the control of Kerala Water Authority will be made available to GCDA for constructing the proposed international stadium. The Honourable Minister for Irrigation, Government of Kerala made an open announcement to this effect during closing Ceremony of the 1993 Santhosh Trophy Football Tournament at Cochin. It was decided during the various meetings and discussions later on that the GCDA will develop and hand over an equal extent of land at Maradu to rehabilitate Kerala Water Authority offices and store that was existing in the stadium project area. 20 acres of land was developed and buildings were constructed at Maradu to rehabilitate the KWA Central Store. The construction of the stadium was taken up simultaneously. Additional 14 acres of land was also acquired from private parties by GCDA.

#### **4B.3 GCDA - ORGANISATIONAL SET UP AND RESOURCE POSITION**

The day to day management of the GCDA is headed by Chairman and Member Secretary. The affairs of the management of this Authority at the time of construction of the Stadium was controlled by the Executive Committee (see Table 4.3) consisting of senior government officials and the General Council (See Table 4.4) consisting of the elected representatives of the State Legislative Assembly within the jurisdiction of this Authority. The desire of the Government of Kerala regarding construction of the stadium was approved by the Executive Committee and the General Council of the Authority and various decisions have been taken by the above bodies enabling rehabilitation of KWA offices, acquisition of land etc.



**Table 4.3 Executive Committee of the Greater Cochin Development Authority  
during Construction of the Stadium**

<b>Sl. No</b>	<b>Name</b>	<b>Status</b>
1.	Chairman, GCDA	Chairman
2.	Member Secretary, GCDA	Secretary
3.	Mayor of Cochin	Member
4.	Chief Town Planner Government of Kerala, Trivandrum	Member
5.	Chief Engineer (Roads) Government of Kerala Trivandrum	Member
6.	Chief Engineer Kerala Water Authority Southern Region Trivandrum	Member
7.	Managing Director Kerala Urban Development Finance Corporation Ltd., Kozhikode	Member
8.	District Collector, Ernakulam	Member

**Table 4.4 General Council of the Greater Cochin Development Authority during Construction of the Stadium**

Sl. No	Name	Status
1.	Chairman, GCDA	Chairman
2.	Member Secretary, GCDA	Secretary
3.	Mayor of Cochin	Member
4.	Existing MLAs from GCDA area (From 9 constituencies)	
5.	Chief Town Planner Govt. of Kerala, Trivandrum	Member
6.	Chief Engineer (Roads) Trivandrum	Member
7.	Chief Engineer (Buildings & Local Works) Trivandrum	Member
8.	Chief Engineer Kerala Water Authority Southern Region, Trivandrum	Member
9.	Chief Engineer Kerala State Electricity Board, Trivandrum	Member
10.	Commissioner Corporation of Cochin	Member
11.	Chairman, Kerala State Pollution Control Board, Trivandrum	Member
12.	M.D., KUDFC Ltd., Kozhikode	Member
13.	District Collector Ernkulam.	Member
14.	President, Indian Chamber of Commerce, Cochin	Member

The Government of Kerala is fully committed to the cause construction of the International Stadium and the interest taken by the government as such, can be seen from the fact that a separate Board of Management under the Chairmanship of the

Honourable Chief Minister of Kerala with 6 cabinet rank Ministers as Vice Chairman (see Table 4.5) had been constituted for the purpose of overseeing the completion of the project within a time frame of 12 months. The entire sports loving people had come forward to render their helping hand for this prestigious project for the whole state and this public enthusiasm also emboldened GCDA to take up this project. Number of meetings of various sections of public were held by GCDA to involve them also in the completion of this project and as a result eleven Advisory Committees in the field of Engineering, Design etc (see Table 4.6) have been constituted and committees had been meeting regularly for finalisation of the design of the stadium. The commitment of Government of India towards sports project can be seen from the fact that donations to a project of this nature is fully exempted from Income tax as per amendment to section 35 AC of the Income Tax Act, incorporated in the Finance Act.

GCDA has developed 204 Nos. of multi-storied residential apartments and sold the same to different customers. This Authority has constructed 306 Nos. Higher Income Group, 780 Nos. of Middle Income Group and 1958 Nos. of Lower Income Group residential units in different colonies developed by GCDA. The Authority has reclaimed about 50 acres of land in the Cochin Marine Drive Scheme the current sale price per cent of land is very high. This is in addition to other assets of smaller holdings in various locations and various commercial complexes including the gigantic GCDA shopping complex at Marine Drive. The net asset position of the GCDA including land and Building is valued at 133 crores as on 31-8-1993. In terms of human resources, GCDA has separate Planning, Civil and Electrical Engineering, Finance and Administrative Departments. The organizational set up of GCDA is shown in Fig. 4B.3.1.

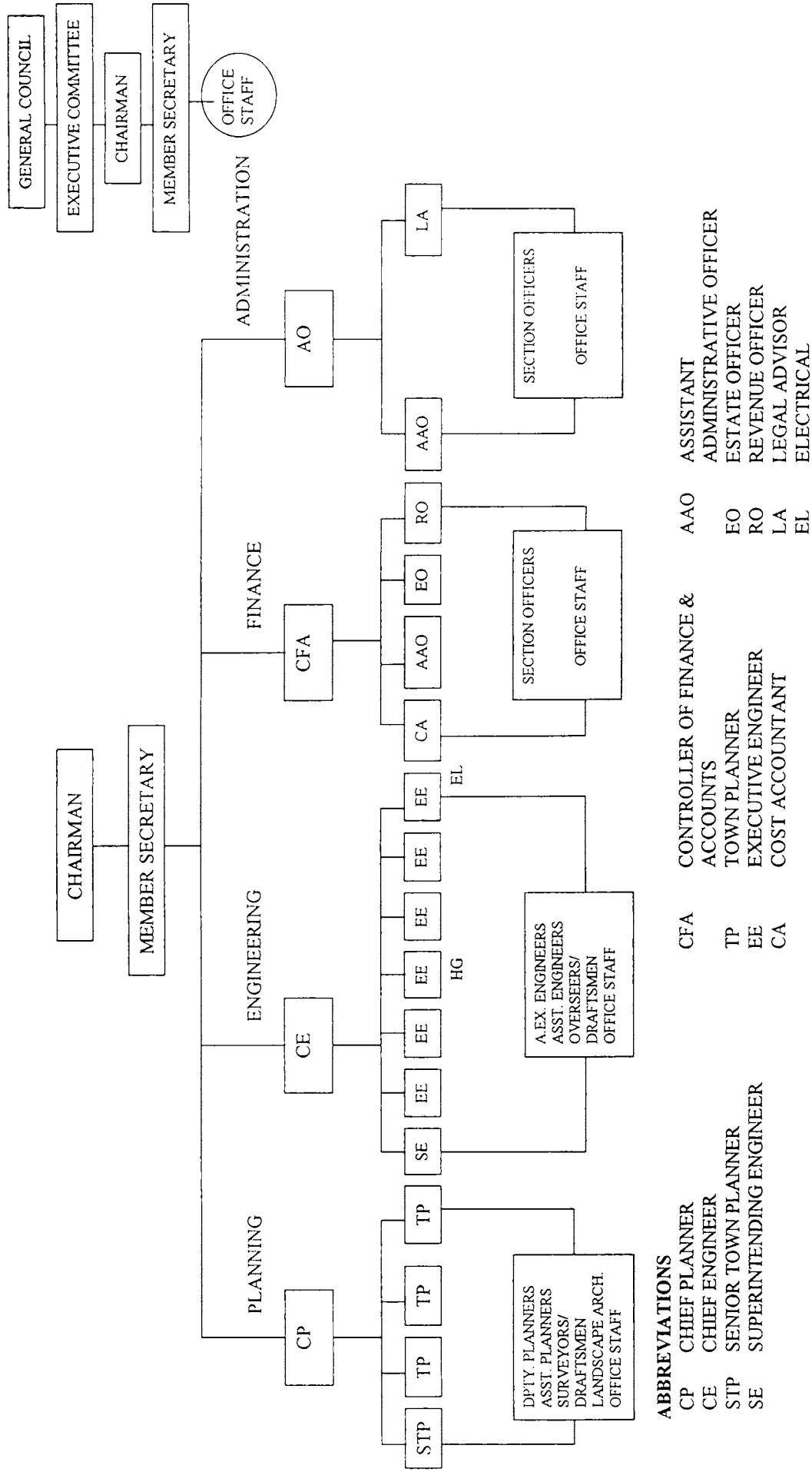


Fig. 4B. 3.1 ORGANISATIONAL SET UP OF GCDA

**Table 4.5 Board of Management for the Stadium Construction**

Sl. No.	Name	Status
1.	Hon'ble Chief Minister of Kerala	Chairman
2.	Hon'ble Minister for Local Administration Government of Kerala	Vice-Chairman
3.	Hon'ble Minister for Finance Government of Kerala	Vice-Chairman
4.	Hon'ble Minister for Irrigation Government of Kerala	Vice Chairman
5.	Hon'ble Minister for Food & Civil Supplies Government of Kerala	Vice Chairman
6.	Hon'ble Minister for Sports & Youth Affairs Government of Kerala	Vice Chairman
7.	Hon'ble Minister for Industries, Government of Kerala	Vice Chairman
8.	Worshipful Mayor of Cochin	Member
9.	Two MPs	Member
10.	Nine MLAs	"
11.	Managing Editor, Malayala Manorama	"
12.	Managing Editor, Mathrubhumi	"
13.	Publisher, Deshabhimani	"
14.	Managing Editor, Deepika	"
15.	Chief Editor, Mangalam	"
16.	Chief Editor, Chandrika	"
17.	Resident Editor, Indian Express	"
18.	Chairman, Federal Bank Ltd.	"
19.	Convener, Nehru Gold Cup Tournament 1995	"
20.	Chairman, KSIDC	"
21.	Chairman, Cochin Port Trust	"
22.	Secretary to Government, Local Administration Department	"
23.	Chairman, Greater Cochin Development Authority	"

**Table 4.6 Advisory Committees**

<b>Sl. No.</b>	<b>Committee and Member</b>	<b>Status</b>
1.	<u>Design Advisory Committee</u> An Architect	Chairman
2.	<u>Engineering Advisory Committee</u> A Chief Engineer (Retired) Kerala P.W.D.	Chairman
3.	<u>Experts Committee</u> President, KFA	Chairman
4.	<u>Monitoring Committee</u> Worshipful Mayor of Cochin	Chairman
5.	<u>Land Committee</u> MLA, Ernakulam Constituency	Chairman
6.	<u>Legal Committee</u> An Advocate, High Court of Kerala	Chairman
7.	<u>Public Relations Committee</u> A Trade Union Leader	Chairman
8.	<u>Liaison Committee</u> Leader of Opposition District, Council, Ernakulam	Chairman
9.	<u>Medical Advisory Committee</u> A Doctor	Chairman

#### **4B.4 OBJECTIVES**

The firm proposal was to construct an International Stadium with seating capacity of 50000 spectators providing facilities for holding international events in Football, Cricket and Athletics. The project will be a major landmark for Kerala, especially for Cochin city as an outstanding contribution by GCDA and Government of Kerala toward promotion of sports and elevating the State to the National level in terms of sports facilities.

The Stadium Complex will certainly bring in wide range of service area which can be utilised for commercial exploitation and will facilitate the overall development of the area. It was visualised that the stadium will be an architectural marvel in the map of Cochin City. The stadium and surrounding areas are to be developed as a centre for social and cultural excellence.

#### **4B.5 THE SITE**

The total area for the project encompasses about 34 acres<sup>(13.77 hectares)</sup> of land facing the Highway at Kaloor, one of the fast developing areas within the city. Out of this an extent of 20 acres<sup>(8.08 hectares)</sup> of land belonging to Kerala Water Authority had been transferred by the State Government to GCDA for the purpose of putting up the stadium and 14 acres of private land adjoining the plot of KWA was acquired by GCDA. Further, GCDA has prepared Detailed Town Planning Scheme for the vicinity area of the stadium complex with a view to provide wide road access connecting the area with National Highway Bye-pass, and the other major city arteries namely Kaloor - Kadavanthra Road and Pulleppady - Thammanam road and other radial roads of the city.

The existing play ground of St. Albert's College adjacent to the stadium is to be retained as a practice ground for the main stadium.

#### **4B.6 ANTICIPATED COMMERCIAL VIABILITY**

The total cost of the project including land was estimated at Rs. 71 crores. Out of this project cost, GCDA was bringing inland cost contribution calculated at Rs. 20 crores and Rs. 2 crores as Promoter's financial contribution to the project. The Govt. of Kerala was anticipated to contribute Rs. 2 crores through budgetary allocation of which one crore had already been announced by the Government in that current year's budget. The Sports Authority of India was anticipated to contribute Rs. 5 crores as the normal grant. An amount of Rs. 20 crore was anticipated to be raised by floating debentures to be subscribed by various banks and other institutions. The debentures were proposed to be redeemable at the end of 15 years. The stadium structure as such will be having 17272 sq. m. of commercially exploitable area which a total revenue of Rs. 2 crore was

anticipated through receipt as deposit, in addition to the recurring revenue of monthly rent. This project being eligible for tax exemption under Section 35 AC of Income Tax Act, a contribution of Rs. 10 crores was anticipated as donations from various companies and institution. It was also anticipated that GCDA would be able to raise Rs. 10 crores by pre-selling of seats for a period of 5 years to private sports enthusiasts in the advantageous areas of the lower tier of the stadium. Anticipated sources for project funding were as given in Table. 4.7.

**Table 4.7 Anticipated Sources for Project Funding**

Sl. No	Sources	Amount
1.	Government Grant	Rs. 7,00,00,000
2.	Pre selling of seats	Rs. 10,00,00,000
3.	Deposit for Commercial Area	Rs. 2,00,00,000
4.	Debentures	Rs. 20,00,00,000
5.	Donation from Companies	Rs. 10,00,00,000
6.	Own Contribution	<u>Rs. 23,27,50,000</u>
	Total	Rs. 72,27,50,000/-

However, as a matter of abundant caution, since the project was for time bound completion, it was felt that the Authority may approach a consortium of the bankers for bridge finance to the tune of Rs. 15 crores. This was being done to cater to the exigency of either short receipt or delayed receipt under any one head of project funding resources for the project.

#### **4B.7 SELECTION OF ARCHITECTS**

Greater Cochin Development Authority had called for competitive offers from reputed architects all over India for submitting their design etc. for expert analysis and short listing. Accordingly 58 architects responded to the advertisements and the 4 architects were short-listed for preparing design etc. for the stadium.



Report on soil investigation carried out by Cochin University of Science and Technology in the month of April 1993 was furnished to the Architects. After their site visits, detailed discussions were carried out with the architects by GCDA officials on the architectural designs to be prepared upon. The short-listed architects presented their respective designs before the members of the Board of Management and various other Advisory Committees on 28-6-1993 and the architectural design submitted by a firm from Madras, was accepted after initial review and modification and they have been appointed as Consultant Architect for the Stadium Project.

#### **4B.8 SOME ENGINEERING DETAILS OF THE PROJECT**

The construction of a stadium of this capacity with all its associate problems was a very enormous and involved task. A few details of the project given below will help to understand the complicity better.

The design was evolved keeping in view the requirements to international standards for football as per FIFA regulations, Cricket and Athletics. A three tier gallery system with desirable sight angles is adopted. The gallery around was proposed to be provided with full roof.

A very important consideration given in the design was in converting optimum space under the galleries into commercial at different levels as under.

Shops and Offices	14,179 Sq. m.
Kalyana Mandapam	2,074 Sq. m.
Conference Hall	<u>1,019 Sq. m.</u>
Total	<u>17,272 Sq. m.</u>

This is with a view to capitalise the maximum advantage of the costly land in the heart of the city. Apart from generating additional income towards rate of commercial space, this will facilitate keeping the stadium precincts always alive even on sports holidays. The stadium essentially is two semi circles connected by two straight parallel stretches. This is to ensure the best viewing angles for Football and Cricket. It can seat 50,000

people and is divided into 8 sectors, seating spectators in three tiered galleries. The two semicircular parts are divided into 3 sectors each and there are 2 sectors in the straight areas. The field comprises of 2 semi circles of 71 m radius connected by a parallel strip 40 m long. The overall field size is 182 M X 142 M. The football field is 105 M X 68M. The Cricket field is a circle of 60M radius. In this same area an 8 lane Athletics Track can also be accommodated.

A three tier arrangement with seating divided in three levels is lower gallery, middle gallery and upper gallery is followed. Lower tier has independent access from lower concourse stairs. Middle and upper tiers have access from ramps.

Shopping area is provided in 2 levels ie., 0.3 M level and 3.47 m level and offices at 7.17 m level and these are segregated from seating galleries. Shopping areas have separate shopping stairs. Each sector thus has 2 lower concourse entries, 2 ramp entries and one shopping entry.

VIP sector has independent access for VVIP's and 2 entries for VIPs. All VVIP activities such as lounge, rest areas, pantry etc. are accommodated exclusively at 7.17 M level. All VIP activities such as lounge and rest areas along with pantry are accommodated at 3.47 m level.

One entry each is provided for media and players. Player facilities and match facilities are limited to inner rows of the H sector. Media facilities are provided at 0.3 m level in the 'A' sector ie. VIP sector. In addition all Camera Platforms, Commentator Boxes, media lounge, communication rooms etc are provided at 21.98 m level.

Two Kalyana Mandapams are provided with necessary dining kitchen and toilet facilities at 0.3 m level. Also 2 rooms are provided at 3.47 M level, which could also be rented out along with Kalyana Mandapam. Concourses are provided for all three galleries. The lower concourse rooms at 3.47 m level, the middle concourse at 12.17 m level and the upper concourse at 21.98 m level. Ramps give access to 4 levels ie., 7.17, 12.17, 16.71, 21.98 m levels. The ramps stop at 16.71 m level and 2 stairs each give access from 16.71 m level to 21.98 m level in each sector.

On the ground floor two ring corridors runs along the circumference of the stadium. The inner corridor runs continuously from the VIP sector to the Kalyana Mandapam sector in both directions, where as the outer corridor is punctuated by the ramps.

The stadium is provided with 2 vehicle ways to facilitate ceremonial and emergency access into the play area.

Conference halls with latest telecom, exhibition spaces etc. are also provided. The other areas that have been concentrated on apart from these are the player facilities. Player facilities are based on the latest FIFA guide lines. Player lounges and dressing rooms are provided for the participating teams. These are self-sufficient rooms with lockers, showers and dressing facilities. Medical aid can be administered in the medical room. In addition there is players gymnasium and physiotherapy facilities.

#### **4B.9 CIRCULATION**

There is a 22 m wide approach road from the highways. Apart from that there is a VIP road also on the western side. The ring road around the stadium is 17 m wide. Two vehicle ways are located on the NW and SE sectors. These are to provide access to police, ambulance and Fire Tenders inside the field. This is a part of the disaster management guidelines of FIFA, which states that any crowd control and disaster prevention force should have unhindered access inside the sport area.

22 vomitories serve each concourse. There are 66 vomitories in all. These allow spillover onto the concourse. From the concourse, one has direct access to the ramps of stairs for evacuation. The vomitories are 3 m wide.

#### **4B.10 STRUCTURE**

(a) Foundation: R.C.C. piles of about 40 m depth below ground level. Number of piles is 2072. Bored cast in situ piles of 500 mm dia and 560 mm dia having a carrying capacity of 105 tonnes and 135 tonnes respectively were installed.

(b) Superstructure: three tier gallery of R.C.C. frame column and beam structure with pre-cast pre-stressed members for the sitting tiers. The entire frame is cast in situ. From a construction management point of view, the casting of the frame will give a lead-time during which period the pre-cast members can be pre-cast and kept ready. Once the frame is cured it can be finished and the members positioned. Each member will be pre-cast, pre-stressed, steam cured and then erected.

(c) Roof: Pre-cast, pre-stressed hyperbolic paraboloid shells were proposed for the roof. For its shape and spans, a hyperboloid paraboloid shell is one of the most efficient in terms of consumption of concrete and steel.

(d) Ancillary Services: The services provided for in stadium are listed as under:

1. Electrification including flood lighting and generator back up.
2. Water supply, sanitary, fire fighting and field irrigation
3. Air conditioning and lifts
4. Public address system
5. Communication Network

A brief explanation of the ancillary services is as below:

**Electrification:** Supply for all the sectors is tapped from a cable trench which runs all around the stadium. A sub station on the site provides, power supply to the stadium. Each sector has its supply main which can be used to disconnect from the main supply in the event of repair and maintenance. Apart from the regular supply, a separate main is provided to supply power to the 4 high mast flood lighting systems. These are the primary light sources for night matches and the luminosity can be adjusted to suit lighting levels for competition Football and Cricket. Critical areas like VIP seating, Media, Lifts and Flood lighting are backed by generator supply. In the event of a power failure, the generator supply is switched on which will maintain a constant lighting level on the playing field.

**Water supply, sanitary and Fire Fighting:** Water is stored in 4 main underground sumps. Flushing sump and drinking sump has a capacity of 1,84,600 litres each. The Irrigation sump has a capacity of 89,900 litres. The fire fighting sump has a capacity of 2,79,300 litres. The water supply sumps are connected to ring mains from which supply to individual toilet block is affected by break tanks. The break tanks capacity for the toilet is 36000 litres. Drinking water is supplied from the UG sump. Break tanks are provided of 36000 litres capacity which supply water to individual drinking water outlets located at each level. Sewage is collected by another ring main and is discharged into a sewage collection well from which it is let into sewage treatment plant.

Fire fighting water is stored in an under ground sump. Each sector has an individual rising main. A hydrant ring is also provided in the field so as to assist fire fighting from inside the grounds.

**Field Irrigation:-** Field supply is effected by yet another ring to which are fixed submersible sprinklers. These pop-up sprinklers are evenly distributed, to ensure uniform water distribution over the field.

Filed drainage is linked to the storm water drains. Perforated earthen pipes are laid below 45 cm depth from the surface of turfing and the pipes are connected to the drains. The surface water will percolate through the soil and get into the perforated earthen pipes from which the water is flown to the side drains.

**Lifts:-** To facilitate easy movement of VIP and Media Traffic to zones which are on the upper levels of the stadium, 2 Nos lifts are provided in the VIP sectors. A and G of these 1 no is meant for the media men, TV crew, commentators only and this can go upto 15 m height. The other is meant for VVIPs and they can go upto 7 m height. For security purposes, the VIP lifts are located inside the building.

**Public Address System:-** The latest FIFA guidelines state that the stadium must be equipped with a PA system. This is to ensure that in event of any emergency, the crowd can be given proper guidance for quick evacuation. Other announcements can

also be made through the PA system during regular match times. The audio system in the stadium has a power of 11.5 kW. About 21 kms long audio cable has been used.

**Communication Network:-** Near the media zone is provision for the parking of "Outdoor Broadcasting" or OB vans. Telex, FAX and ISD/STD line will be provided in the media zone, VIP zone and in the tournament organizers offices, during tournament periods. Closed circuit monitoring system will be put in place if a need so arises.

With roof work deferred for want of funds the structure does appear unfinished. This was also pointed out by the then MLA during the time of inauguration that the stadium without roof appears "like a soldier without a cap".

#### 4B.11 SALIENT FEATURES

The salient features of the stadium are as in Table 4.8.

**Table 4.8 Salient Features of the Stadium**

Location	Erstwhile KWA central store at Kaloor
Total project area	34 Acres (13.77 hectares)
Turfing area	12 Acres (4.84 hectares)
Width of road around the stadium	17 metres
Total earth filling at site	16,167 lorry loads
Construction cost	Rs. 63 crores
<u>Foundation Details:-</u>	
Total number of piles	2072
Average length of pile	40m depth 50 cm dia & 56 cm dia.
Total length of piles	82.84 kilometers
Total length of Grade Beams	14 kilometres
<u>Structural Features:-</u>	
Height of the structure	21.98 metres
No. of entries to lower tier (steps)	14 nos
No. of entries to the middle and upper tiers (Ramps)	16 Nos.

Seating capacity	50,000
Sports facilities	Football, Hockey, Cricket & Athletics (International Standards)
Commercial space with the stadium	17,272 sq. meters
Shop rooms	165 Nos.
Office space	76 Nos.
Godown facility	20 Nos.
Marriage Hall, Kitchen and allied facilities	1440 Sq. m
Restaurant	200 Sq. m
Physiotherapy Centre	1 No.
Player's waiting room	4 Nos (Ground Floor)
Organising Committee room	1 No
VIP Facilities	First Floor
VVIP Facilities	Second Floor
No. of. Chair in the lower tier	21,442 Nos
Middle tier seating capacity	18,574 Nos
Upper tier seating capacity	9984 Nos
Total length of Pre-stressed seating elements	27 Kms
Total quantity of cement used	24,514 Tons (4,90280 bags)
Emergency evacuation time	8 minutes
Total quantity of steel (6mm to 35mm)	7,952 Tons
Electrical :-	
Flood light capacity	1600 Lux
Type of bulbs used	Metal Halide 2000 Watts HNF12
Total number of bulbs used	384 Nos
Emergency lighting fittings type NVC52	32 Nos
No of elevators	4 Nos
Power generation capacity with substation	1500 KVA
Total length of electric cable used for the structure	75 Kilometres
Height of the lamp mast	41.0 metres

<b>Audio System :-</b>	
Total power output	11.5 kw
Total length of Audio cable	20.1 Kilometres
No. of. Speakers used	1192 Nos
<b>Telephone System:-</b>	
Total No. of Terminals	1000 Pairs
Total length of telephone cable used	1.5 kilometres
Total length of fire hydrants	2.1 Kilometres
<b><u>Other facilities</u></b>	
Capacity of semi ground level water tank	7,38,400 litres
Sewaget Treatment Plant & Capacity	1 No. - 750 m <sup>3</sup> /Day
Total distance of water supply line	7.5 kilometres
Over head water tanks	8 nos
Overhead water tank capacity	30,000 litres each
Play field drainage	Underground gravitational
<b><u>Parking Facilities:-</u></b>	
Cars	1500 Nos
Two wheelers	1000 Nos
Buses	150 Nos
<b><u>Toilets:-</u></b>	
Total number of toilets	71 Nos
Field irrigation	Sprinkler irrigation system
Time stipulated for the completion	365 days
Time taken for the completion	515 days
Project Promoter	Greater Cochin Development Authority
Consultant Architect	C.N. Raghavendran M/s C.R. Narayana Rao Architects, Madras
Main Contractors	Hindustan Steel Works Construction Ltd. Calcutta (A Govt. of India undertaking)



A paper titled "The International Stadium - A National Dream" in a Souvenir of Kerala Public Work Department was published, by Abdul Salam (1995) when the construction of the stadium was in progress. Another paper titled "The International Stadium at Cochin" was also published after the construction of the stadium in a Souvenir published by the Institution of Engineers (India).

#### **4B.12 FINALISATION OF CONTRACTORS FOR CONSTRUCTION OF STADIUM PROJECT**

Advertisement inviting application for Pre-Qualification Registration of Contractors for the Construction of proposed multipurpose International Stadium Project at Cochin was published in the press by GCDA in the month of July, 1993. It was notified that no further tender notice will be published in the press and issue of tender forms will be restricted only to those who apply now, provided they are found suitable. 17 firms responded to the advertisement. GCDA issued the tender drawings and tender documents prepared by M/s C.R. Narayana Rao, Architects to the 17 firms. A pre-bid meeting was held at GCDA's office on 29-11-1993, with due advance intimation to all tenderers so as to give an opportunity to all intending tenderers to seek clarifications, if any, from GCDA and Architects. All tenderers had been requested to furnish to GCDA on or before 22.11.'93 a list of clarifications, sought by them. Eventhough not all tenderers submitted their questions in advance as requested, it was decided by GCDA during the pre-bid meeting to accept questions that were realised even during the pre-bid meeting so as to ensure that all tenderers have an uniform and through understanding of GCDA's tender conditions.

Incorporating the clarifications/decisions furnished by GCDA during the pre-bid meeting and also other modifications to conditions and schedule of quantities/drawings etc. additional documents were furnished to all tenderers by GCDA. Tenderers were also advised as below:

1. Date of Submission of tender extended as 28-12-93. Earlier due date of submission of tender was on 30-11-93.

2. Since all issues raised by tenderers were answered by GCDA during the pre-bid meeting, no further conditions were to be stipulated by the tenderers with the tender.

Only four tenders were received by the stipulated date.

Tenders were opened at GCDA conference hall on 28-12-1993 at 3.30 PM by the Member Secretary, Greater Cochin Development Authority in the presence of GCDA officials, Architects and the representatives of the above four tenderers. The quoted amount of the tenderers as opened are furnished below:

1. Firm No. I	Rs. 71,76,65,936/-
2. Firm No. II	Rs. 76,97,88,333/-
3. Firm No. III	Rs. 81,58,41,342/-
4. Firm No. IV	Rs. 88,31,15,774/-

Immediately on opening of tenders, a comparative statement was prepared by the consultant Architect in which he listed all major aspects of tenders (other than price-bid), such as E.M.D., Security Deposit etc; and also listing various conditions stipulated by the four tenderers and furnished to GCDA. Later, on detailed scrutiny and arithmetic check of the Bills of Quantities priced by the tenderers, a detailed report on tender was furnished to GCDA confidentially by the Architect in which he had pointed out all the errors in the above four tenders and advised GCDA that there is a possibility of substantial reduction, if negotiations are conducted.

Some important points of the Architect's Report worth considering are as follows.

1. It can be seen that the total estimate as per Architect is Rs. 58.03 crores against which the grand total of the lowest itemwise tendered amount alone comes to about Rs. 63.08 crores.

2. All the tenderers have quoted substantially higher rates when compared to the estimated cost. The variation of the total amount quoted ranges from 21.4% to 45.2% in comparison with the total estimated amount.
3. As per the instruction of GCDA received earlier, Architect's estimate was prepared on the basis of the rates of the KPWD Schedule of Rates. However, this work consists of several specialised finishes and services for which the corresponding items were not available in the Scheduled Rates of KPWD. For such items, they have adopted the estimated rates based on market rates and in certain cases of specialised services, their rates are based on quotation from specialised agencies. This practice was followed in special services like lifts, air-conditioning, fire fighting, field irrigation, gallery seating etc. Even amongst items involving use of concrete, they could adopt the scheduled rates of KPWD only for a limited items involving use of concrete, viz. Most of the in situ concrete work. For all pre-cast and pre-stressed concrete works, there were no corresponding items in the Schedule Rate of KPWD. The same applies for piling also. For these also they adopted the market rates. On an overall review, they pointed out that items falling under the Schedule of Rates of KPWD are less than 30% of the entire magnitude.
4. On verification of market rates for certain standard building materials such as bricks, sand, aggregates, mosaic tiles, timber etc in the market and on comparing them with the basic rates furnished in the Schedule of Rates of KPWD, they find that a substantial difference exists, the market rates being higher by about 20% to 30%. Similarly their enquiries also reveal that the labour rates prevailing appears to be much higher than the labour rates permitted in the S.R. On account of these factors, the final rates, if derived on the basic market rates, will be bound to be higher than the KPWD Schedule of Rates. Also, in general, the tenders received are higher than the KPWD Schedule of Rates by about 25% to 30% even for conventional and simple buildings.
5. In the KPWD data, only 10% is allowed towards contractor's overheads and profits. Generally, major contractors work on a margin of 20% to 30% in their rates towards overheads and profits for major works. This work being a time bound, special nature, turn key project of high magnitude involving complex construction methods with minimum construction period, will also call for heavy equipment, heavy plant and machinery such as a number of high capacity cranes, batching

plants, site laboratory transit mixers, concrete pumps, dumpers, tippers, compressors, generators etc. Also, a large labour force will have to be engaged and round the clock work without holidays will also become necessary. A number of specialist works are involved, particularly involving pre-cast and pre-stressed concrete work, considerable expenditure will have to be incurred by the contractor for setting up casting yards, steam curing etc. The contractor has to invest heavy amounts on equipments, plant and machinery and also incur expenditure on over time for labour, which will also involve heavy investment on infrastructure.

6. The tender condition stipulates that all materials including cement and steel have to be procured by the contractor and there are no Departmental supply of materials. The tender also stipulates that in the case of cement and steel, no basic prices are to be taken and that any fluctuation during the currency of the project in the price of all materials including cement and steel as well as of fluctuations in labour, transport, taxes, duties etc. will have to be borne by the contractor within his quoted rates.
7. The contractor has also been given the responsibility for all major infrastructure, in particular, arrangement of water and power at his own cost. On account of factors 5, 6 and 7 the allowance of 10% towards overheads and profits, as per the KPWD Schedule of Rates practice will not be followed by the contractors while quoting the tenders. It is more likely for the contractors to adopt 25% to 30% towards this.
8. A firm from Lucknow has not quoted for the roof items furnished i.e., pre-stressed concrete roof beams and concrete Hyper Shell roof elements, as given in the tender documents. But they have furnished a lumpsum amount of Rs. 5.86 crores towards a roofing alternative of their own design, consisting of steel girders and steel space frame. However only a very preliminary sketch has been submitted on a single A4 size sheet, not giving any details, rendering it impossible to evaluate the proposal. They have also not furnished a list of projects of comparable nature which they have executed in the past. This is a serious factor which works against their offer. In the light of the above, the Architect suggested that the offer of UPRNN may be eliminated from further consideration. Though the consultant Architect was of the view that negotiations could be had with three firms, GCDA chose to negotiate with M/s. HSCL considering HSCL is a Government of India undertaking.

**4B.13 NEGOTIATION BETWEEN HINDUSTAN STEEL WORKS  
CONSTRUCTION LTD. AND GREATER COCHIN  
DEVELOPMENT AUTHORITY**

A high level meeting was held for negotiating on tender amount between the Chairman, HSCL and the Chairman GCDA on 11-2-1994. Team of officers on either side met at 3 pm on 11-2-94 in the office room of the Chairman, GCDA and had detailed deliberations regarding the necessity for the HSCL to bring down the rates further to the rates already quoted by them. The Chairman HSCL and General Manager (Marketing) explained their problems.

It was pointed out by the Secretary, GCDA that if the work is undertaken by HSCL, they shall reduce the rate atleast to Rs. 71.77 crores which was quoted by the lowest tenderer. The arguments put forwarded by the Secretary was further clarified by the officers of GCDA. Chairman, HSCL pointed out that the rate of 71.77 crores was quoted by the lowest tenderer on the basis of their making available only 80 ton capacity crane and with certain conditions. It was made very clear by the consultant Architect during the first day of negotiation with HSCL that 300 ton capacity Mobile Crane is an absolutely essential item for the project work. The Chairman, HSCL clarified that M/s HSCL has arranged a 300 ton capacity crane and confirmed it by fax to GCDA and that they will not be in a position for any further reduction whatsoever to the 4% already offered. The deliberation regarding item wise rates quoted by HSCL and other companies went on till 18.30 Hrs. on 11-2-1994. Negotiation was resumed at 11.00 hrs on 12-2-1994 in the Chairman's office. M/s HSCL after prolonged discussion among themselves and with their head offices etc. has given a reduction proposal that they are willing to reduce the tender rate further by 0.5% which will bring down total reduction from the tendered amount to around Rs. 73.52 cores. On further detailed discussions it was finally agreed upon that HSCL will give a total reduction of 4.75% over their quoted amount as a last word, beyond which they are not able to undertake the work. The GCDA officers also came to the conclusion that there is no point in prolonging the discussion. Finally it was agreed that the final tender amount shall be 4.75% below the quoted rate of M/s HSCL. The negotiation came to a close at 12.00 hrs and the minutes of meeting was signed by the General Manager (Marketing) HSCL

and the member Secretary, GCDA in the presence of the Chairman GCDA and the Chairman & Managing Director, HSCL.

HSCL infact was the second lowest bidder and after negotiation, HSCL became the lowest tenderer and was awarded the contract at a total cost of Rs. 73.32 crores. Thus Hindustan Steel Works Construction Ltd. Calcutta (a Government of India undertaking) was finalised as the Main Contractor for this multi-crore project.

#### **4B.14 CONSTRUCTION OF INTERNATIONAL STADIUM AT COCHIN: COMPLIANCE OF PRELIMINARY REQUISITES**

The contract agreement for the above work was concluded between Greater Cochin Development Authority and Hindustan Steel Works Construction Ltd. on 17<sup>th</sup> March, 1994. It was on 27<sup>th</sup> March 1994 when the foundation stone for this stadium was laid by the then Chief Minister of Kerala, in the presence of then Speaker Kerala Legislative Assembly, and then Ministers for Local Administration, Irrigation, Finance, Sports & Youth Affairs, Industries, Food & Civil Supplies. The count down for the 365 days' time frame for this 73 crore project was ticked-off on that day, considering the promise of the Chairman and Managing Director of HSCL that work on the stadium would be completed in 365 days from the day the foundation stone was laid. Accordingly a board was also put up on the Highway side just opposite the stadium site to display the number of "days remaining for completion". But with regard to the time of completion the stipulation in the contract was to complete the work within a period of 365 days with effect from the date of handing over the site. The site required for the commencement of the work was handed over to the contractors within a month's time only due to the following reasons:

- a) The Central longitudinal area defined by two compound wall West & East was under charge of M/s Kerala Water Authority (KWA) with their materials stored both in covered godown as well as in the open area.
- b) The Eastern side was in occupation by private owners

- c) Both the western & eastern areas immediately after the respective compound walls were low lying, marshy and water logged. There was also a broad longitudinal drainage course on the western side adjoining the compound wall.

GCDA swung into action immediately and succeeded to do the following in a month's time.

- a) Vacating part of the area occupied by M/s KWA.
- b) Demolition of 4 godown of M/s KWA upto ground level
- c) Demolition of the compound wall on the western side.
- d) Partial diversion of the drainage course.
- e) Got the low lying area on the western side filled up through HSCL.

GCDA then instructed HSCL to take up the piling work in the limited area thus made available to them. Accordingly HSCL look over the limited area on 17-4-1994 and started their activities. Handing over note with a sketch of the site was also made out and formal site handing over report was acknowledged between the Assistant Engineer, GCDA and the Deputy General Manager, HSCL.

The clear site as per the tender could not be handed over. Later this led to a dispute between HSCL and GCDA. Immediately after signing the agreement HSCL started mobilising its resources for the job prior to the inauguration ceremony. Settling down to business HSCL constructed its own as well as GCDA's office at the site. Roads leading to the site, a 500 kV transformer for electricity, a laboratory for Quality Control Department and a store were quickly made ready so that the initial job of land survey, soil testing etc. can be taken up immediately. The main tarred approach road was not at the disposal of HSCL and they had therefore to make an alternative one through the garbage filled area. As bulk of the area was under occupation of M/s KWA there was severe congestion in the working areas and supply of various materials required for the work had to be hand to mouth.

For perfect levelling and alignment of all structures of the stadium it was essential that a survey was done. The first impediment HSCL had to face was in setting

out the grid points on which the Architect himself had his own objections and reservations since the boundary wall on the eastern side was coming in the way. The situation was tided over somehow by punching holes and slits in the walls by trial and error methods. The entire survey work was performed by 2 teams of 4 people in each group comprising of one surveyor, one Assistant Surveyor and 2 Assistants. In the survey work for piling SOKKIA SET ZC II popularly known as INTELLIGENT TOTAL STATION was used. This extremely advanced electrical equipment fixed the piles alignment, distance, height without measuring. This zero error equipment saved precious time and man power.

Since the land was marshy more than 16,167 lorry loads of earth were used to fill the site.

#### **4B.15 SELECTION OF SUB-CONTRACTORS**

As per the Contract Agreement, as soon as practicable and before awarding any sub-contract, the contractor shall notify the employer/Architect in writing the names of the sub-contractor proposed for the principal parts of the work and for such other parts as the Architect may direct, and shall not employ any to whom the Architect or the Employer may have a reasonable objection. As per the above clause, GCDA in consultation with the Architect had permitted HSCL to employ the sub-contractors to carry out the works under different sub-heads as in Table 4.9.



**Table 4.9 Details of Sub-Heads of Works**

<b>Sl. No</b>	<b>Name of Sub-Head</b>
1.	Development works, pile & pile caps:-
2.	General Builders work:- 3 Sectors (A, D & H Sectors): 2 Sectors (B & C Sectors): 2 Sector ( F & G Sector): 1 Sector (E - Sector):
3.	Pre-stressed Concrete Seating, elements:-
4.	Electrical installation:-
5.	Water Supply, sanitary and Fire fighting works:-
6.	Storm Water Drainage:-
7.	Anti-corrosive treatment to steel reinforcement:-
8.	Sub station, roads & U.G. Sump:-
9.	Sewage Treatment Plant:-
10.	Telecommunication and Public Address System:-
11.	Play field Irrigation:-
12.	Play field preparation:-

M/s HSCL had engaged the sub-contractors for the respective works.

#### **4B.16 COMMENCEMENT OF THE STADIUM WORK**

Nearly 27 piling rigs were installed. Due to the fact that only limited areas have been handed over, GCDA instructed HSCL to concentrate the piling rigs in H and A Sectors.

The construction of the stadium has been commenced by installing first pile on 17-4-1994 on a time bound basis which was to be completed within 365 days.

The balance acquired land on the eastern side was developed by GCDA and handed over to the contractors on 07-06-1994.

The various operations for piling work had to be done in filled up area which got severely affected due to heavy rains. The monsoon broke very early that year right from the second week of May '94 and severity was unprecedented for the past 30 years. This fact had been vouched by the media itself. Heavy rains dragged on till middle of September, 1994. There was continuous heavy water togging and knee deep slush throughout the area and it was an ordeal to manage site inspite of pressing into service numerous pumps. The approaches made at various locations were also washed off. The nature of operations involved such as movement of dumpers, trucks, cranes, dozers etc. even in good virgin ground could be affected by such rains. So the condition in filled up soil with water standing throughout can only be extremely miserable. The piling subcontractor had mustered upto 29 rigs against HSCL's commitment of 24. Under the severe conditions which existed no work anywhere near the normal norms could be achieved and the entire output became too meagre for efforts put round the clock. In such adverse conditions, anyone would have discontinued the work till monsoons recede. But the contractors continued the work against all odds for the sake of this prestigious project for which they were committed. While the contractors were struggling in the Western area in the above manner GCDA started their efforts to free the Eastern area of its encumbrances, fill up the area for handing over to HSCL. In this effort GCDA had to face their share of the ordeal. Whereas they succeeded to a great extent to physically evict the occupants of the area, and also to dismantle the compound wall, the filling work carried out resulted in rendering the area slushy, swampy and unapproachable and the work had to be left at a stage beyond which it could not proceed.

#### **4B.17 REMEDIAL MEASURES TAKEN TO ACCELERATE THE PROGRESS OF THE WORK**

Since the targetted progress in work was not achieved due to bad weather conditions, it was found essential that immediate remedial measures were to be adopted to retrieve the situations.

Chairman, HSCI was requested to visit Cochin and take necessary steps for improving the piling out put reviewing the overall performance in the project. The,

CMD of HSCL visited Cochin on 11-7-1994 and had discussions with GCDA officers. It was also pointed out by the CMD and his officers that the piling work was below the expected rate of output mostly due to the existing slushy and muddy conditions in the project area due to unprecedented heavy pre-monsoon and monsoon rains. The CMD suggested that the only method to improve productivity in the project is by ensuring that the site was made hard enough by stabilising for workers to move about freely and also free vehicular movements. Discussions were carried out the methods to be adopted to achieve stabilising of the work areas. It was pointed out that stabilising of the muddy areas can be achieved only by dumping gravel or similar quality material. It was then pointed out that gravel may not be available at present due to the extreme rainy condition in the area where such materials are available. It was then discussed as to whether river sand/pit sand currently available can be substituted and utilised for stabilising the working areas. GCDA officers pointed out that river sand is costlier compared to pit sand for which there is rates in the contract M/s HSCL, considering the gravity of the situation, agreed to use river sand despite the fact that the river sand is costlier and also agreed that they will be willing to accept the rate that is available for pit sand. Considering the present site condition, it was pointed out by HSCL that they should be permitted to avail of the facility of lorry measurement. It was then agreed that such facility will be extended to HSCL and subsequently Chief Engineer had issued special orders in this behalf.

The piling work started again. The labourers had to be provided with gumboots as walking on foot was impossible. When the piling started (Bore driven piling has been done here or one can call it Direct Mud Circulation Method) problems were plenty.

When the holes were made huge quantities of muck got accumulated at the site. Removing this muck was a Herculean task. In order to expedite the piling bentonite was used, as bentonite did not allow lighter mud (Bentonite being heavier) to get into the bore. Altogether 2072 piles were driven each ranging from 40 to 42 M in depth and 50-55 cm dia from the core of its foundation. To imagine this in terms of distance and the magnitude of piling work involved, the total length of piling will be 90 Kms. and of

grade beams to 14 kms. probably a distance same as a journey from Ernakulam to Udayamperor.

#### **4B.18 IMPLEMENTATION COMMITTEE**

An Implementation Committee under the Chairmanship of then, Commissioner of Police was monitoring the progress of work every week and giving instructions whenever necessary. There was a feeling of fear among the trade union leaders, since Police Commissioner himself was fully involved the execution of the project. There was full co-operation from the police department. A police aid post with constables was also set up at the site to look after the law and order problem. The GCDA countdown to complete the stadium in 365 days suffered a mild jolt on 28<sup>th</sup> June 1994 when majority of the workers kept away from work. This was following a scuffle between a policeman and a labourer, and 5 days of work were lost on account of this. The workers resumed work on 4<sup>th</sup> July '94 onwards after an agreement was reached between them and the Implementation Committee.

#### **4B.19 PILE LOAD TESTS - STATIC AND DYNAMIC TESTING**

The piling job had to pass some acid tests. As per the contract agreement all load tests shall be carried out in accordance with the provisions of IS-2911 (Part IV) 1985. Working load is the actual load to be borne by the pile as indicated on the drawing. Test load was a load applied on selected single pile at 50% excess of the working load and for a group of piles at 50% excess of the working load in a manner as directed by the Architects.

Static load tests:- Static load test is the traditional testing method 25 Nos. of static load tests were carried out.

Dynamic Testing for 2 nos piles were carried out to ascertain the integrity of piles. The tests were carried out on 30<sup>th</sup> and 31<sup>st</sup> May 1994. The test results could be seen on the monitor.

## **4B.20 PROJECT IMPLEMENTATION**

After the contracts are executed, the next and main activity ie., project implementation is started. The project implementation can be performed effectively and efficiently only when, there is a strong projects team and leadership. The tasks of the project team is challenging. The system of project execution is based on an integrated project management organization. GCDA had highly staffed project organization for the implementation of the stadium project. Chief Engineer heads the Engineering Department. This department is always headed by a very senior level executive highly qualified and experienced. The Executive Engineers in the department are also equally qualified and experienced and are assisted by the junior level officers from the levels of Assistant Executive Engineers, Assistant Engineers and Overseers. CFA (Controller of Finance and Accounts) is the in-charge of project finance department. He is administratively under the control of the Secretary.

## **4B.21 REVIEW OF PROGRESS - DAILY MEETINGS**

In the process of execution and monitoring of this project, PERT was used. Computerised monitoring was also done.

At the stadium site, daily meetings were held by the Chairman, GCDA with all the concerned officers including consultants and contractors to review the position of:

- Progress of work
- Receipts of equipment and other materials at the site
- Progress of work by contractors
- Deployment of erection equipments by the contractors
- Critical areas needing immediate attention.

Delays and short falls in any area were critically reviewed and immediate action was taken to improve the performance by the failing agencies.

## **4B.22 CONSTRUCTION OF MAINFRAME & GENERAL BUILDING WORK**

Soon after the piling job, the work of construction of Mainframe and General Builders work started in different eight sectors. The construction of the main frame superstructure involved 22,000 m<sup>3</sup> of concreting and 8495 m<sup>3</sup> of brickwork. Nearly 8,000 tonnes of steel and 24,500 tonnes of cement have gone into its making.

## **4B.23 CONSTRUCTION OF PRE-CAST PRE-STRESSED GALLERY SEATING ELEMENTS**

In the contract, provision for the three tier gallery of seating elements was with pre-cast R.C.C. seating elements. But it was changed to pre-cast pre-stressed after lengthy deliberations at site meetings with a view to complete the work within the stipulated time. There was some constraints to get the adequate land required for the construction of pre-cast R.C.C. seating elements, and its storage, from Kerala Water Authority. Also, R.C.C. seating elements cannot be put to use without 28 days' curing. But in the case of pre-stressed seating elements, it can be put to use for erection after 10 hours steam curing. Pre-stressing is a technique by which permanent stresses are created in a structure either in advance or simultaneously with the application of external load of such magnitude that these will give rise to resultant stresses which at all cross sections and for all stages of loading will be within the permissible limit range of the material throughout the life of the structure. In the manufacture of seating elements at Cochin pre-tensioning method of pre-stressing in which the tendons are tensioned before concrete is placed, have been used. In this method prestress is imparted to concrete by bond between steel and concrete. Pre-stressed concrete offers greater technical advantage in comparison with other forms of construction such as reinforced concrete and steel. In case of fully pre-stressed members, free from tensile stresses under working loads, the cross section is more efficiently utilised, when compared with a r.c section which cracks under working loads. Within certain limits, a permanent dead load may be counteracted by increasing the eccentricity of the pre-stressing force in a pre-stressed structural element, thus effecting savings in the use of materials. The two structural features of pre-stressed concrete namely high strength

concrete and freedom from cracks contributes to the improved durability of the structure, under aggressive environmental conditions. In pre-tensioning system, the tendons are first tensioned between rigid ends of the tensioning bed and the concrete is subsequently placed and compacted to the required shape and size. After the concrete hardens, the tendons are released from the pre-tensioning bed and the pre-stress is transferred to the concrete.

For the lower, middle and upper tier seating elements, one end is fixed and the other end is movable. This is for casting two seating elements. In pre-stressing work various losses occur to the prestress. Most of them are taken care of in the design like loss due to creep, shrinkage, elastic shortening etc. The losses which we can measure are losses due to anchor slip and end slip.

The concrete mix used for middle and upper tier seating element is M40 and for lower tier it is M45. Higher strength mix is used in lower tier as it has to resist the prestress of 40 HT code. Shutter vibrators are used to compact the concrete. Strict quality control of the work is very important. The concrete has to be very dense. Any void left after concreting will cause the tensioned wires to rust resulting in the loss of stress and final collapse of the structure.

After the concreting, at 5 cm from the end of the mould, on the wires, permanent marking is made with paint. This is done for the purpose of measuring detension slip. The element is covered with tarpaulin and left for 2 hours before starting steam curing. Steam is let in through the perforated pipes provided in the bottom of the stressing bed. The element is steam cured for 10 hours. Minimum curing condition is 800 centigrade hours. The primary object of steam curing is to develop high early strength of concrete, so that it can be removed from the mould and handled as early as possible. Steam curing should be followed by water curing for at least 7 days. In the absence of this supplementary wet curing for atleast 7 days, the later age strength of steam cured concrete may be lower by 20 to 40% than that of normally cured concrete. After the steam curing, the element is left for 2 hours to cool down before the wires are detensioned. Detensioning or transfer of prestressing force is done with hydraulic jack. Two hydraulic jacks are placed on both sides of the

stressing bed and the pressure is applied in such a way that the force taken by the movable end is transferred to the jack. Then the nuts provided on the movable side are removed. Now the complete load will be on the jack. The hydraulic pressure is then released gradually by the control mechanism thus ensuring a smooth and gradual transfer of pre-stressing force to the element. The tendons are found to move a little in the concrete on release. This is termed as endslip. End slip of individual wires (tendons), if any are recorded. Before steam curing, we have marked at 5 cm from the edge of the mould with a standard scale. So after detensioning, we again measure with that scale the distance of that mark from the edge of the mould. The difference, if any is the end slip. End slip is measured at both ends. Then the wires are cut with suitable mechanical or flame cutter. The mould is then loosened and the seating element is taken out of it, placed in the yard in the upright position and wet cured for 7 days before transporting for erection. It may be mentioned here that 21,442 moulded chairs have been provided in the lower tier while in the second and third tier PCC seating elements have been provided. About 27 kms of pre-stressed seating elements have been used. There are 14 ramps for the upper and middle tiers and 10 exit points for the lower tier.

#### **4B.24 QUALITY CONTROL**

A Quality Control Department of the contractors was set up for strict quality ensurement. The work of casting and erection of pre-stressed concrete gallery has been done with M 40 and M 45 grade concrete. For attainment early strength of concrete steam curing method was adopted. There was too much of salinity, moisture content was very high and GCDA insisted on anti-corrosive treatment for reinforcement rod. The Designer's requirement was that anti-corrosive treatment should be done first and then the concreting. The challenge was how to cope with it Central Electro Chemical Research Institute, Tamil Nadu (CERI) have patented a process for treating rods. Though it is a slow process, their process was followed. It takes 36 hours to carryout but still it was managed to do it without affecting the time schedule. Altogether 20,000 cubes of 15 cm were tested to compare the strength of concrete poured at different structures prepared and the Quality Control Laboratory. The concrete mix used for upper and middle tier is M-40 and M-45 has been used in



lower tier. Cement, bricks and all other building materials were also put to test before use.

#### **4B.25 ELECTRICAL WORKS AND ARENA LIGHTING**

The electrical works done in the stadium is of high order. Electrical lighting and fitting works involved greater magnitude and volume. Altogether 75 Kms of cable has been used (big and small) in trenches, walls and grounds. For the coverage of the play by TV transmission there are 3 rows of 22 Metal Halide imported Philips bulbs of 2 kw each. For the line lighting in Roof Masts in H & E and D & B Sector 70 lamps (Metal Halide) each of 2 KW each in both the sectors have been provided. The roof masts (4 nos.) have been designed fabricated and erected by HSCL. These 4 roof masts weighing 382 tonnes have been placed atop the stadium. These 60° - 70° bend arch shaped pipes have been fabricated from 12 mm sheets with rolled doubler plates to strengthen them. After welding the joints were X-rayed, ultrasonically tested and die penetrating tests were carried out to ensure that no cracks remained. Subsequently these were erected with the help of 2 nos. Derric and 955 crane. Of the 4 nos flood light masts the first one proved to be a difficult one. Because of soil conditions heavy rains and consolidation etc. the work could not be taken up in right earnest so it took nearly a months time to erect it; But the remaining 3 masts were erected within a month. The 4 Nos. arena lighting masts erected atop the incomplete roof at a height of 25 M lend crowning glory to the entire stadium. The glow that emerges from them can be seen miles away. There are altogether 376 lights (88 metal halides and 6 halogen bulbs) in each light mast. The light arrangement is such that the light is uniform everywhere upto 10 m above the ground level. For TV projection 1200 Lux is sufficient but the capacity here is 1600 Lux.

For general lighting 4 nos of light mast 30 m high having 9 sodium vapour lamps of 800 Watts have been provided. The electrical works etc. include construction of an Electrical Sub Station building where in 2 Generator (Diesel) of 750 KW each of KEL make and 2 Transformer of 11 KV x 433 volts have been installed.

By the side of the electrical sub station and underground sump room has also been constructed which provides an electrical pump to provide water to the stadium both for drinking and maintenance purposes.

#### **4B.26 PUMP AND UNDERGROUND SUMP ROOM**

	Concrete water tank capacity:
	7,38,400 ltrs divided into 4 sectors
1) Drinking sump	1,84,600 Ltrs
2) Flushing sump	1,84,600 ltrs
3) Fire fighting sump	2,79,300 Ltrs
4) Irrigation sump	<u>89,900 Ltrs</u>
	<u>7,38,400 Ltrs</u>

Power of the Pump : 7.5 HP

No. of Pumps : 4 nos

Make of the pump : Operations Sprinkler 2: 7.5 HP

#### **4B.27 SEWERAGE TREATMENT PLANT**

A Sewerage Treatment Plant has been installed for sewage facilities. The total scope of work under Sewerage Treatment Plant (STP) was to the tune of Rs. 44.57 lakhs. The following units had been constructed. (1) Aeration Tank work has been executed in two parts viz. a) 1.50 M<sup>3</sup> per day load design of 6 MX6MX2.74 M size and (b) 750 M<sup>3</sup> per day during Match season of 15 M X7.5 M X2.7 M size (2) Settling Tank. (3) Clarifier (4) Return Slush Sump (5) Pump House (6) Sludge Drying Bed and (7) Filterate Collection Sump. Apart from this 2 Nos. of collection Sump with Pump House have also been constructed near H & D sector. The mechanical items installed include 2 Nos. Surface Aerators of 7.5 HP and 1 NO. of 5 HP besides, one clarifier of 7 M dia. In the Sewerage Plant 2 Nos. of 1 HP and 2 Nos. of 2 HP return sludge pumps have been installed. Similarly Raw Sewage Pumps have also been installed in addition to piping works of high density polythene pipes connecting raw

sewerage to aeration tank and all inter connections with valves etc. have also been carried out.

#### **4B.28 EQUIPMENT USED**

The equipment used in the project are as in Table 4.10

**Table 4.10 Equipment used for the Construction of the Stadium**

<b>Sl. No</b>	<b>Equipment</b>	<b>Nos.</b>
1.	Hydraulic Mobile Cranes - 10 tons (8000)	2 Nos.
2.	Cranes Tata P & H 955 ALC - 74 tons	2 Nos.
3.	Tata P & H 320crane 25 tons	2 Nos.
4	JCB Excavator Loader	1 Nos.
5.	Weigh Batchers JP & Ashoka 650 kg. Capacity	6 Nos.
6.	Concrete Mixers 10/7 cubic metre capacity	1 No.
7.	Batching Plant 1 cu. Yd. Capacity Millers	3 Nos.
8.	CPT Air compressor	1 No.
9.	Road Roller	1 No.
10.	Tractor & Trailer of 15 T	2 Nos.
11.	Capacity/Hindustan & Escorts	2 Nos.
12.	Bull dozer, D 50 A - 15	2 Nos.
13.	Truck - Tata 1210 S Model	1 No.
14.	Self loader - Leyland	1 No.
15.	HCL/Computer with Printer/UPS System	1 No.
16.	Elec. Winch 5 T capacity Sureka Make	2 Nos.

#### **4B.29 EXTENSION OF TIME OF COMPLETION OF THE STADIUM**

It was earlier envisaged that the stadium will be completed within a year and HSCL also was given a years time for completion. The decision was taken hastily by looking into the time limit given to L & T for completion of the Jawaharla Nehru Stadium at Madras. When compared with the Madras Stadium the Kochi Stadium stands out in magnitude and class particularly when its foundation details are taken into

consideration. For the Kochi Stadium 2072 piles were installed when compared to 500 piles in Madras. The work on the International Stadium at Cochin could not be completed when the 365 days' deadline expired. A multitude of factors hampered the completion of the project. The delay can be mainly attributed to the unprecedented heavy monsoon which slowed the piling work. Apart from the delay on the part of the contractor, the Kerala Water Authority from whom the land was transferred to GCDA was "putting spokes in the wheel" in the transfer of balance land, instead of helping out. The KWA had not shifted its stock of pipes from the stadium plot to the designated area at Maradu, which was allotted to it by the GCDA in exchange. This was depriving G.C.D.A of space to stock the tonnes of steel required in the construction. Heavy girders had to be got ready to erect the roof of the stadium, as and when the structure was completed. GCDA had completed work on the buildings for KWA at Maradu in time. But the shifting of central store of KWA to Maradu could not be carried out early as expected.

As per the request of M/s HSCL, the time of completion of the stadium was extended upto 25<sup>th</sup> December, 1995 by the General Council of GCDA, without invoking the penal provisions. The construction of the roof was also deleted from the purview of the contract by the General council, reducing the contract amount to Rs. 64.71 crores instead of the original contract amount of Rs. 73.32 crores. The board which used to display the number of "days remaining for completion" now indicated the number of "extra days incurred due to the contractors fault". The inauguration of the stadium was on 14<sup>th</sup> February, 1996 when then President Dr. Shankar Dayal Sharma dedicated the International Stadium to the nation among the fervent cheers of applause from the spectators. As per the contract condition, the date of completion of the work has to be certified by the consultant Architect. The Architect certified the date of completion as the 31<sup>st</sup> May, 1996.



**INSIDE VIEW OF THE JAWAHARLAL NEHRU INTERNATIONAL  
STADIUM AT COCHIN**



**A SECTION OF SPECTATORS WATCHING THE INAUGURATION  
FUNCTION OF THE STADIUM**

#### **4B.30 EXCELLENT PERFORMANCE OF GCDA**

International Stadium is an epitome of GCDA, the concrete, the bricks, the reinforcement and the ingenuity that have all made it plausible, the fait accompli that needs to be conveyed is that brightest promise lies in GCDA's versatile successful implementation competence. This is yet another feather in GCDA's illustrious cap and has by its trend setting example made its presence felt in the construction as well as sports map of Kerala.

It was only dedication and a good team work that GCDA could complete the spectacular construction within a record time. The entire team of GCDA officers has been ably led by the Chairman, GCDA who had steered the project from the very beginning and has seen it through, winning admiration and accolades from all. Total commitment by GCDA to make that dream come true at any price is the secret of success behind this venture.

The entire work was completed in a period of 515 days, which is publicly acclaimed by all, to be a major engineering achievement. Seldom has a mega project been executed with such a high pitch of excitement where the entire energies, pressure, team work and total devotional content in meeting the dead line were synchronized so ably and amicably.

The rather impossible was achieved in the implementation of this project with whole hearted and devoted work of a team of GCDA Engineers. The proud moments of the GCDA and the encomiums and accolades, showered on this Authority by news papers, AIR and Doordarshan has been achieved only with the commendable and sincere hardwork done by officers of this Authority. The Engineers were awarded a Good Service Entry by the Chairman, GCDA, for their devotion to work. Then the President of India dedicated to the nation the International Stadium constructed by GCDA at Kaloor, Cochin on 14<sup>th</sup> February 1996 among fervent cheers and applause from the spectators. It was a momentous occasion for GCDA collective when GCDA epochal venture won standing ovation from all those who were present on the occasion to witness the inaugural ceremony packed to capacity.

While dedicating the Rs. 70 crore International Stadium to the nation the President said "I have immense pleasure in associating myself with this important function which will herald a new chapter in the sports life of the beautiful city of Kochi and indeed of Kerala as a whole. I would like to congratulate all those who have toiled over many months for building this sports stadium. With its state-of-the-art facilities, this complex will offer tremendous opportunities for both the players and spectators". Union Minister of Industries said, "The stadium which was completed in a record time without a single manday having been lost on account of strike has a larger message for Kerala. It is that the bureaucracy in the State can measure up to any challenge and that any public undertaking can do wonders it has a dedicated and committed leader.

## **4C. CONSTRUCTION OF COCHIN INTERNATIONAL AIRPORT, NEDUMBASSERY**

### **4C.1 INTRODUCTION**

Cochin International Airport at Nedumbassery was dedicated to the nation by the President of India on 25<sup>th</sup> May, 1999. It is India's first airport that has been completed with public equity participation. It has got lot of specialities.

Situated in 1300 acres, close to Kalady, the Cochin International Airport has two terminals one for handling domestic passengers with a floor area of 10,000 sq. mtrs and the other for handling international passengers with 14,000 sq. mtrs. The fully air-conditioned terminals are designed in typical Kerala style architecture with exquisite interiors.

The longest runway in South India in a coconut grove at Kochi extends to 3400 metres with a cement concrete apron of size 425X125 sq. mtrs, sufficient enough to park 8 aircrafts at a time, including 4 wide bodied aircrafts. The airport, with night landing facilities inclusive of category 1 Approach Lighting System, Precision Approach Path Indicators, Sophisticated Electronic Navigational Aids, Instrument Landing System (ILS) for 24 hours operation is also equipped with a sophisticated

control tower cum technical block, the tower height being 50 metres, a cargo complex measuring 4500 sq.m spacious car parking facility for 1100 cars, duty free shopping complex, state-of-the art hydrant re-fuelling system for aircrafts, and a most modern fire station conforming to category 8 safety standards etc. Excellent customs, Immigration and security systems are provided. An exclusive visitors gallery is also provided in Domestic Terminal. Passenger facility also will be of international quality with common check-in-counter (departure control system), baggage reconciliation systems, boarding control systems etc. which are fully computerised and automated. In fact, no effort has been spared to ensure that every facility made available here is of world class standards. Indeed this is the first of its kind in the country. The Cochin International Airport Project is the natural outcome of the liberalisation policies extended by the Government of India. The project has been executed with public participation especially with that of NRI's of Kerala origin. This is the maiden project in the history of Civil Aviation in India that an airport was constructed on Build, Own & Operate (BOO) basis by a Public Limited Company with private participation. The total outlay of CIAL is Rs.230 crores.

#### **4C.2 BACK GROUND**

Cochin International Airport project has been envisaged to overcome the shortcomings of the existing Naval Airport. The existing airport near Willingdon Island belongs to the Indian Navy. The main runway is 6,000X150 feet while the second runway is only 4650X150 feet. The main runway is suitable for operations upto Boeing 737 that too with a load penalty, due to limited runway length. The runway can be used only from one side because of the presence of high cranes at the northern side. The airport is bordered with the Arabian Sea and backwaters on three sides. The length of runway is also insufficient for base aircraft of Indian Airlines (AB320). There is no scope for runway extension, unless land is reclaimed from the sea, which is prohibitively cost and time intensive.

In June 1987, a committee of Union and State Government department was constituted to make recommendations and cost estimate for the development of Cochin Airport so that wide bodied jets can land here. In the meeting convened by the Union

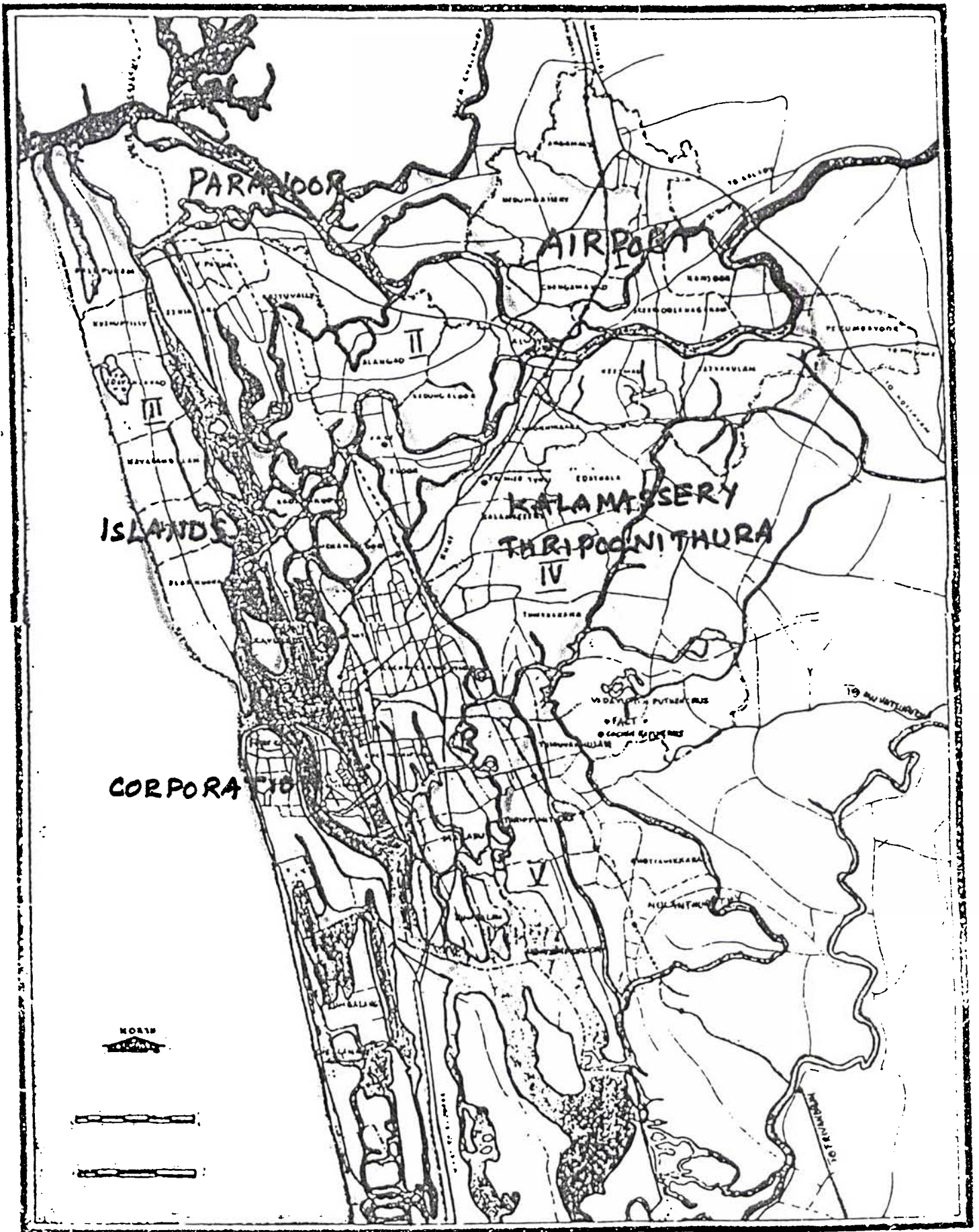


Minister for Civil Aviation and Tourism at Delhi in October 1991, the recommendation was considered in detail. However it was pointed out that the total expenditure would be about Rs. 70 to 72 crores at 1991 price level and the expansion would take at least nine years. In this meeting, the local MP suggested that if the expenditure for the expansion of the secondary runway is estimated at Rs. 70 to 72 crores, it would be better to construct a new airport. A runway that can facilitate the landing of wide bodied jets like Airbus 300, Boeing 747 is absolutely necessary in the context of the policy of Indian Airlines to phase out the aero planes like Boeing - 737 in the next decade. Accordingly the District Collector was authorised to find a suitable land for the construction of a new airport.

Sites at Thengode (near Kakkanad), Udayamperor, Edakkattuvayal, Amballor (near Aluva) were identified. The officials of National Airports Authority visited all these places and made their observations. The site at Nedumbassery was found to be the most suitable one and the NAA in the month of August 1992 approved the site. The geographic location of the Airport is very strategic since it is at the meeting point of NH 47 and MC Road. The main railway line is also passing very close to the airport.

The site at Nedumbassery is located at a distance of about 25 kms, from Kochi city, while it is only 6 kms from Angamaly and Aluva municipal towns. It lies about four metres above the mean sea level. About 1500 acres of land were proposed to be purchased/acquired for the setting up of the airport. Of this, about 1100 acres of wet land with one crop paddy cultivation. There were about 200 dwelling houses with a population of approximately 1900 people within the alignment of about 400 acres of dry land. Even though most of the area was wet land, it is not prone to flooding during the monsoon. Since Aluva and Angamaly towns are only 6 kms away, all the facilities of the towns are available in the area. Fig. 4.C.2.1 shows the location of the airport in the GCDA area.

Fig. 4.21 GREATER COCHIN DEVELOPMENT AUTHORITY AREA.



### **4C.3 FORMATION OF COCHIN INTERNATIONAL AIRPORT LTD.**

The preliminary project report prepared by the then Ernakulam District Collector, Mr. V.J. Kurian, about six years ago, had outlined a novel method of raising funds for the project which was then estimated to cost Rs. 85 crores.

Two lakh Keralites, mainly NRI's, were to be persuaded to lend Rs. 5,000 each interest free for the project for which they would be given Indira Vikas Patrika totalling Rs. 2500 each. By encashing these certificates they would be able to realise the loan amount after five years. The money realised from the sale of Patrikas and the Government loan that would be available on funds so mobilised were to be the principal means of funding the project, apart from donations from industrialists, exporters and co-operative societies.

Though the fund raising campaign was launched and extended to foreign countries, it did not generate flow of funds on an expected scale. It was at this juncture that this plan was dropped in favour of a new plan to set up a Government promoted company for implementation of the project. This change in strategy was crucial in not only keeping the project alive, but also vastly improving the prospects for raising the required funds for the project.

While the Kochi International Airport Society, which was formed in July 1993, mainly to pave way for land acquisition, the project implementation was taken up by the Cochin International Airport Ltd. (CIAL) which was registered on March 1994 with an authorised capital of Rs. 90 crores. The Government was expected to provide 26 percent of its equity.

### **4C.4 PROJECT COST & FINANCING PATTERN**

Though the inflow of funds was not smooth, the Government did not sanction funds towards its equity for quite sometime. Finally Rs. 1 crore was sanctioned in March 1996. The project struggled for survival due to acute financial scarcity. The project was being implemented in two phases. Though the project cost of Phase 1 as

per the original project report was 162.82 crores, on account of the steep increase in the cost of land acquisition, the project cost had to be revised to 204.48 crores, financed by equity capital of Rs. 68 crores and debt to the tune of Rs. 136 crores. The debt component was fully tied up with HUDCO and Federal Bank Ltd. HUDCO has financed through a term loan of Rs. 98 crores guaranteed by Government of Kerala. Subsequently HUDCO has sanctioned Rs. 45.43 crores also making the total assistance to Rs. 143.43 crores. Out of Rs. 68 crores Equity Capital, the company has privately placed shares worth Rs. 60 crores of which major contribution is from NRI's. The project was given a new shape in course of time.

The construction of the Cochin International Airport has involved an award of over a hundred contracts all of which have gone to the lowest bidder, according to the project authorities. They insist that they have been able to insulate themselves from the usual "pulls" and "pressures" that dog such projects. The biggest contract was for the runway construction, which went to a Hyderabad- based company which quoted the lowest amount of Rs. 72.63 crores. The next highest amount that was quoted by a Delhi - based firm was Rs. 79.31 crores and the highest amount quoted by a Chennai - based firm was Rs. 135.82 crores. The construction of the runway in multiple layers was a gigantic task involving the use of lakhs of bags of cement, sand and vast quantities of sand, steel, metal and bitumen. Its 1.42 metre thickness is made up of laterite soil above the OMC (Optimum moisture compacted) surface. The other layers comprise a mixture of quarry dust, metal and sand, followed by layers of wet mixed macadam, bituminous macadam and asphaltic concrete. Built with the assistance of consultants from abroad, a laboratory at the project site was used extensively to monitor its construction according to the prescribed specifications. The cost of the terminal buildings has been estimated at roughly Rs. 32 crores. Of the remaining part of the project cost of Rs. 230 crores land acquisition has accounted for Rs. 65 crores.

#### **4C.5 COMPOSITION OF CIAL**

The project of Cochin International Airport is implemented by COCHIN INTERNATIONAL AIRPORT LIMITED (CIAL), whose chairman is Hon'ble Chief Minister of Kerala. The Public Limited Company has 12 Directors in the board,

comprising of representatives of NRIS, Exporters, Industrialists and Peoples representatives.

As per planning to make the Airport demand driven rather than facility driven, the Board of Directors have planned II<sup>nd</sup> phase for expanding the facilities as per demand in term of passenger terminals, parallel and high speed taxiways, cargo facilities, Radars etc.

Initially, the proposal was to go in for a Public Issue of shares by April/May 1998 for the purpose of listing the shares in the stock Market. But due to the uncertain capital market conditions, the company has decided to postpone the issue by another year.

In August 1997 the Government has issued order enhancing the Government holding in the Company to 51 percent.

#### **4C.6 THE MAIN CONTRACTORS**

The contract for the construction of the runway, apron, taxi track and fencing was awarded to a firm from Hyderabad while the contract for the construction of the terminal buildings was awarded to a firm from Bangalore. The construction of Air Traffic Control Tower, Utility Buildings and Fire Stations was entrusted to M/s. HSCL Calcutta. Rs. 18.5 crore the fuel farm Hydrant system built by M/s BPCL is the first of its kind in South India. Company has entered into a lease agreement with M/s. BPCL for 20 years to provide the above facility in the airport.

The Airports Authority of India has agreed to carryout the Air Space Management and Communication for this Airport. The installation of equipments have been taken up by Airports Authority of India. The details of civil works and contract are shown in Table 4.11 of Electrical works as in Table 4.12, and of operation works as in Table 4.13.

**Table 4.11 Cochin International Airport - Details of main Civil Works**

Sl. No.	NAME OF WORK	ESTIMATE AMOUNT	CONTRACT AMOUNT	COMPLETION PERIOD	DATE OF WORK ORDER
1.	CONSTRUCTION OF RUNWAY. APRON ETC.	58,12,39,288/-	71,97,49,510/-	32 MONTHS	17-03-95
2.	ACCOMMODATION	47,13,379/-	65,98,731/-	06 MONTHS	"
3.	FILLING IN REHABILITATION AREA	47,00,000/-	36,81,972/-	03 MONTHS	13-11-97
4.	CONSTRUCTION OF TERMINAL BUILDING	8,96,15,220/-	9,22,85,754/-	12 MONTHS	23-12-96
5.	ATC PILE FOUNDATION	56,93,000/-	53,63,250/-	03 MONTHS	12-04-97
6.	AVANAMCODE ROAD	44,95,512/-	35,08,721/-	06 MONTHS	24-06-97
7.	ATC & OTHER BUILDINGS	5,50,00,000/-	6,26,13,979/-	10 MONTHS	15-07-97
8.	IMPROVEMENT TO ROAD IN REHABILITATION AREA		5,32,600/-	01 MONTH	18-10-97
9.	FALSE CEILING	1,29,92,386/-	1,11,39,400/-	06 MONTHS	18-11-97
10.	DEVELOPMENT WORKS IN REHABILITATION AREA	43,26,000/-	43,37,075.37/-	06 MONTHS	06-12-97
11.	CAR PARK	4,70,00,000/-	4,07,39,600/-	06 MONTHS	06-12-97
12.	IMPROVEMENT TO ROAD IN PONT 'C'	4,36,950/-			
13.	OVER HEAD WATER	60,59,000/-	58,10,031/-	05 MONTHS	16-01-98
14.	BLACK TOPING OF CAR PARK INFRONT OF PASSENGER	2,24,80,184/-	2,14,28,111/-	06 MONTHS	23-04-98

15.	CONSTRUCTION OF GSE SHED, CARGO BUILDING DUTY FREE GODOWN ETC	5,13,84,288/-	4,95,34,454/-	08 MONTHS	18-04-98
16.	INTERIOR DECORATION WORKS IN TERMINAL BUILDINGS	1,07,25,000/-	78,99,234/-	04 MONTHS	18-04-98
17.	SEWAGE TREATMENT PLANT INCLUDING CIVIL & ELECTRICAL WORKS	86,19,797/-	86,85,212/-	04 MONTHS	18-04-98
18.	EXCAVATION OF PROPOSED CHENGAL THODU DIVERSION WORK	30,00,000/-	14,63,237/-	02 MONTHS	02-05-98
19.	CONSTRUCTION OF COMPOUND WALL IN SOUTHERN SIDE OF RUNWAY	10,00,000/-	11,35,950/-	02 MONTHS	11-05-98
20.	VITRIFIED TILE FLOORING IN TERMINAL BUILDING	2,01,80,450/-	1,56,43,400/-	04 MONTHS	13-06-98

**Table 4.12 Details of Electrical Works**

Sl. No.	NAME OF WORK	ESTIMATE AMOUNT	CONTRACT AMOUNT	COMPLETION PERIOD	DATE OF ORDER
1.	ELECTRIFICATION OF TERMINAL BUILDING	1,49,86,000/-	1,40,86,840/-	09 MONTHS	11-07-97
2.	AIR-CONDITIONING OF TERMINAL BUILDING	4,31,39,636/-	3,81,61,800/-	09 MONTHS	08-07-97
3.	FIRE FIGHTING & ALARM SYSTEM	57,47,597/-	51,72,837/-	09 MONTHS	08-07-97
4.	GROUND LIGHTING FACILITIES	2,53,29,400/-	2,36,04,505/-	09 MONTHS	26-07-97
5.	AIR-CONDITIONING OF ATC BUILDING	1,02,43,494/-	99,71,150/-	08 MONTHS	01-10-97
6.	LIFT - ATC BUILDING	26,00,000/-	20,50,600/-	08 MONTHS	30-09-97
7.	11 KV SUBSTATION EQUIPMENTS	3,90,77,057/-	3,85,30,526/-	08 MONTHS	04-10-97
8.	FLOOD LIGHTING OF APRON & CAR PARK	1,34,54,467/-	1,20,49,821/-	06 MONTHS	06-12-97
9.	ELECTRIFICATION OF ILS & DVOR	58,08,649/-	52,81,830/-	04 MONTHS	06-12-97
10.	CONVEYOR BELTS	1,20,00,000/-	95,68,700/-	05 MONTHS	06-12-97
11.	ESCALATOR FOR TERMINAL BUILDING	80,00,000/-	79,70,000/-	05 MONTHS	03-01-98
12.	PICTOGRAPHS/SIGN BOARDS	10,71,600/-	9,70,710/-	03 MONTHS	14-05-98
13.	SPLIT TYPE AIR CONDITIONING FOR ILS & DVOR BUILDING	5,86,200/-	5,77,590/-	02 MONTHS	18-08-98
14.	AUTOMATIC SLIDING DOORS	18,28,000/-	17,72,800/-	02 MONTHS	12-10-98
15.	S I T C OF WATER SUPPLY PUMP SETS & ACCESSORIES	4,22,107,91/-	4,85,415/-	02 MONTHS	



**Table 1.3 Details Of Operation Works**

Sl. No.	NAME OF WORK	ESTIMATE AMOUNT	CONTRACT AMOUNT	COMPLETION PERIOD	DATE OF WORK ORDER
1.	SUPPLY OF AIRFIELD CRASH FIRE TENDERS, AIR FIELD RESCUE TENDER, POWER DRIVEN SAWS ETC.	.....CIF	DM 2,219,910/- + INR 1,05,732/-	10 MONTHS	03-11-97
2.	SUPPLY, INSTALLATION TESTING & COMMISSIONING OF 02 NOS. PASSENGER BOARDING BRIDGES INCLUDING FIXED TUNNELS.	FOB	US\$ 535,585/- + INR 9,96,850/- US \$ 79,500/-	7 ½ MONTHS	06-12-97
3.	SUPPLY, INSTALLATION TESTING & COMMISSIONING OF FLIGHT INFORMATION DISPLAY SYSTEM & PUBLIC ADDRESS SYSTEM	FIDS RS. 79,65,000 PA RS. 34,74,000	1,00,14,000/- 33,90,000/-	05 MONTHS	19-05-98

#### **4C.7 IMPORTANT STRUCTURES/FACILITIES IN PHASE - 1**

Following are the important structures constructed in Phase - 1.

- International, Taxiway and Apron
- Domestic Terminal
- Car Park
- Cargo Terminal
- Air Traffic Control Tower
- Fire Station
- Sub-station
- Instrument Landing System
- Fuel Farm
- Compound wall
- Runway lighting system
- Compound wall and peripheral Road

#### **4C.8 RUNWAY, TAXIWAY AND APRON**

The overall length of the runway is 3700 m and width is 45 m. Kochi Airport has the second largest runway in the country after that of Delhi. The shoulder width on either side is 7.5 m. The runway strength is PCN 60 which is capable of landing the Jumbo Jets.

Present taxiway is about 1000 m, width is 23 m and shoulders are with 105 m. Apron has a dimension of about 420 m x 125 m which can accommodate 4 wide bodied aircrafts and 4 narrow bodied aircrafts at a time. The work on these areas had commenced in April 1995 and completed in April 1999.

#### **4C.9 DOMESTIC & INTERNATIONAL TERMINALS**

Built in typical Kerala Architecture, Domestic Terminal has an area of 1000 sq. m and International Terminal of 1400 sq. m. Both the terminals are centrally air-conditioned. The peak hour passenger handling capacity of both the terminals is 400

incoming passengers and 400 outgoing passengers. Both terminals have spacious lounges for passengers, restaurants, VIP lounges, shopping areas etc. The International Terminal has two Aero bridges also. The Aerobridge costing about 7 lakhs US Dollars each has been imported from China and erected with the suspension of Chinese Engineers. A very attractive duty free shopping facility also is being provided. The work of both the terminals had been commenced in February 1997 and completed in March 1999.

#### **4C.10 CAR PARK**

The car park is a sprawling one. Two parking lots for each terminal capable of accommodating 550 cars each. The Domestic and International terminals have separate entry and exit gates. Separate space is provided for private cars, taxis, buses, VIP vehicles etc on the parking area. The work of car park commenced in December '97 and was completed in March '99.

#### **4C.11 CARGO TERMINAL**

Separate cargo Terminals were built here for import, export and unaccompanied baggages. Separate entry and exit gates are also provided for the cargo terminals with sufficient space for parking of vehicles. The work of cargo Terminal commenced in April 1998 and completed in March '99.

#### **4C.12 AIR TRAFFIC CONTROL TOWER**

This is the nerve centre for airport operations. The concrete control tower is located at an elevation of 50 m so that both ends of the runway are clearly visible for an efficient control of aircraft operations. ATC tower is perhaps the tallest structure in the region. On the top of the ATC tower about 50 metres high, perched on huge metal girders, the structural shell of the glass enclosure inside which the air traffic control officials will sit, directing operations has been built. Adjacent to the tower, the roof tops of the national and international terminal buildings can be seen amid a sea of coconut

palm. The installation of the navigation equipment is over. A panoramic view of the transformation of Nedumbassery can be had from the top of this tower. The work of ATC Tower was commenced in November 1997 and was completed in April 1999.

#### **4C.13 FIRE STATION, SUBSTATION, INSTRUMENT LANDING SYSTEM AND THE OTHER INFRASTRUCTURES**

The fire fighting facility available is of category of 8. There are fire fighting vehicles and there is an observation tower also. The work was commenced in November '97 and completed in December '98. There are two substations in the air port. The installation works of the generators, transformers etc. was completed in March '99. This is an aid for a safe aircraft operation in bad weather. The work was completed in April '99. A full fledged fuel station is provided here with a fuel hydrant system with which fuel can be pumped to the aircraft straight and need not be carried in. The total length of the compound wall is about 13 km. The compound wall is constructed as per the security standards laid down by Civil Aviation security. Peripheral road is provided for the movement of inspection vehicles. The works were carried out by the local contractors. The runway lighting system is of category - 1 and will be helpful for night landing. The work was completed in April '99. The huge imported light masts are used for lighting up the entire complex.

#### **4C.14 OTHER FACILITIES**

The other facilities include VIP and CIP (commercially important persons) rooms in each of the terminals, a shopping area with 28 shops in the domestic terminal and 7 shops in the international terminal as well as a duty free shopping area of 800 sq. m, apart from 10 immigration and customs counters each. A transit lounge, an executive lounge and other amenities such as restaurants, bank counters and postal facilities are the other facilities available.

Mechanised baggage handling and reconciliation systems, boarding control systems, X-ray baggage machines, escalators and two aero bridges in the international terminals form part of the infrastructure.

All the facilities provided are at par with international standards.

#### **4C.15 MONITORING MECHANISM**

Managing Director of the company and heads of various discipline used to meet once a week (Tuesday) formally to discuss all the programs, priorities and strategies to be adopted. Then once in every week (Friday) all the works were reviewed at site by Managing Director with the field workers. This was followed with a site inspection also. These weekly meetings were very useful for clearing any pending issues and for taking critical decisions etc.

#### **4C.16 CONSULTANTS**

M/S. HOK (HELMUTH, OBATTA & KASABAUM) Inc. USA is the Architectural consultant for the terminal complex, fire fighting substation and for ATC Tower.

M/s. EMA (ENGINEERS & MANAGEMENT ASSOCIATES), New Delhi is the consultant for the Runway Design. M/s. KITCO (KERALA INDUSTRIAL TECHNICAL CONSULTANCY ORGANISATION), Cochin is the consultant for the Passenger Terminal, Cargo Terminal, Car Park etc.

#### **4C.17 SUPERVISION AND CONTROL OF EXECUTION**

Policy decisions were taken by the Board of Directors of CIAL headed by the Chairman. Chief Executive of the Project is the Managing Director.

For Runway, Taxiway, Apron, Compound walls and Peripheral roads etc. The Project Engineer of CIAL was the Engineer-in-charge with limited staff (IAEE & 3 AES) of CIAL at key positions. Main supervision was by the Project-Management Consultants viz. EMA-NATPAC consortium with 26 Engineer Supervisors. For ATC Building, Fire Station, Sub Station, ILS Buildings etc. Direct supervision by CIAL, Executive Engineer

(civil) was the EIC with IAEE & 2 Aes. For Terminal Buildings, car park cargo Buildings etc, E.E. was the co-ordinating officer from CIAL. Main supervision was by M/S. KITCO with 10 Engineers/Supervisors.

For Electrical Services and Air-conditioning:- The Executive Engineering (El.) assisted with 2 AEEs and 4AEs from CIAL side. M/s. KITCO with 4 Engineers in the PMC.

#### **4C.18 PHASE - II**

A modern II<sup>nd</sup> terminal building is planned under Phase II programme

The building would have 40000 sqm area with all modern passenger and other facilities. American Architectural Consultants were selected based on Global Competition, to prepare the Architectural drawings, estimates etc. A parallel taxiway for the entire length of runway with high speed link taxi ways between runway and parallel taxi way is planned. An Apron of size 500 Mtrs x 125 Mtrs. in front of the Second Phase Terminal Building to accommodate 12 Aircraft. State of the Art Radar is planned including automation of communication and Air Traffic Control Systems. Ultimately, the surroundings of the airport is planned to develop as the total self sufficient township with Star Hotels, Recreation centres, Commercial Establishments, Export zones etc. It is also planned to extend the existing railway line into the airport complex to serve both cargo and passenger movements. A Spacious integrated Cargo Complex including Cold Storage, Courier Service area, valuable, diplomatic, hazardous Cargo areas.

#### **4C.19 LAND ACQUISITION - A SOCIAL PROBLEM**

Implementing a project of the dimensions of the Cochin International Airport in a state with a high population density like Kerala has naturally thrown up quite a few problems, for it involved the displacement of thousands of people.



**CITY SIDE VIEW OF PASSENGER TERMINALS WITH SPACIOUS CAR PARK FACILITY AT COCHIN INTERNATIONAL AIR PORT**



**AIR TRAFFIC CONTROL TOWER - UNDER CONSTRUCTION**

A total of 1300 acres have been acquired so far for the project. About 2600 land owners had to give up their land to make way for the airport. It has involved the rehabilitation of 822 families and as many as 400 cases relating to land acquisition were filed in court.

The land acquisition in two phases for the runway and the terminal buildings marked a turbulent phase for both the land owners and those involved in project implementation. The land acquisition process was entangled in a mix of persuasion, negotiation and even a bit of bulldozing, apart from politicking. Some of the landowners fought a bitter battle right till the end to retain the property they owned, sometimes even leading to their arrest. Ultimately the majority of land owners opted for a negotiated settlement.

The carrot that was offered to the landowners who opted for a negotiated settlement was a rehabilitation package that included six cents of land free for each family irrespective of the extent of land acquired, payment of Rs. 10,000 to help them shift their property, including usable portions of their houses, to the new site, valuation of property without providing for depreciation, payment of Rs. 50,000 for those who did not opt for six cents of land and a rehabilitation area with essential infrastructure like bitumenised approach roads, streets lighting, electricity and water connection.

One of those who surrendered their land for the airport project was provided with a job in the airport company. The compensation package was "fair" but rued the fact that the commercial value of the surrendered land had increased manyfold after the project work began.

The latest conflict that was averted through negotiation related to the cutting down of nearly 2000 trees in the land belonging the various people in the airport vicinity, to meet the requirements of the Civil Aviation authorities. It was after protracted negotiation and some delay that a deal was finally clinched and the cutting down of trees got into full swing just a week or so before the airport was to be inaugurated. Even temples had to be relocated, and sacred trees cut down.



A major irrigation canal and four roads had also to be diverted. All things considered, the sailing has not been entirely smooth for the airport project, but that was to be expected given its size. That is why that it might surprise some that it has become a reality at all.

#### **4C.20 NETWORK TO NEDUMBASSERY**

The new Cochin International Airport that has come up at Nedumbassery is about 26 kms from Kochi. The airport site is close to all the three National Highways passing through the State about 11 km from NH17, 3 kms from NH47, 25 kms from NH 49 and 3 kms from the State highway, MC road, connecting Thiruvananthapuram and Angamly.

For those travelling to the airport from the nearest big city, Kochi, the ADB project to widen NH 47 between Aluva and Cherthala has proved a boon. As a result of the widening of the of the Kochi - Aluva stretch of NH 47, travel between the city periphery and Aluva now takes roughly 20 to 25 minutes compared to the hour or more it used to take before the road was widened.

The Public Works Minister told the Assembly while replying to a calling attention motion by Aluva MLA on June 22<sup>nd</sup> '99 that steps were being taken to construct a network of roads to the Nedumbassery airport. According to the Minister, the widening of the Angamaly to Aluva stretch of the highway to the construction of a parallel bridge to the Marthandavarma bridge were also on the cards and project reports had been submitted to the Centre for clearance. The widening work was estimated to cost Rs.6.3 crores and the parallel bridge Rs.8.4 crores. The State Government had in March submitted a proposal costing Rs. 40.16 crores to the centre for the development of roads in this region.

## **CHAPTER - 5**

### **DISCUSSIONS AND RECOMMENDATIONS**

The typical case Studies and Critical Analysis on time and cost overrun in construction in the previous chapters lead to fruitful discussion to bringout relevant factors to improve the performance effectiveness in project implementation and to formulate certain strategies in construction management with a view to improve the efficiency and economy in construction.

#### **5.1 DISCUSSION ON THE IMPLEMENTATION OF THE PROJECT - KERALA LEGISLATURE COMPLEX**

The first phase of the project of Kerala Legislature Complex was completed in the year 1986, with a total cost of 13.55 crores, executed through the local contractors on tender basis, under the supervision of Kerala Public Works Department. Second phase of the project was mainly construction of 8 storeyed Legislative Assembly building. The design and implementation of the 2<sup>nd</sup> phase was done by the Kerala P.W.D as usual since this was Government a sponsored project. The construction of the Assembly building was entrusted to Kerala State Construction Corporation by the Government of Kerala in the year 1986. The agreed PAC of the original contract was 9.71 crores. The agreed time of completion was 4 years. Through KSCC started the work in the year 1986 in right earnest on a CPM charted out planned programme, the work did not progress according to the schedule. The project was completed in May 1998. It took 12 years to complete the 2<sup>nd</sup> phase. The value of the work done by KSCC in this project is 34.14 crores. Important point worth mentioning is work to the tune of about Rs 16 crores was executed during the last spell of 2 years. The reasons for the time and cost overrun of this project can be summarized as follows.

1. Inaccuracies in input data for planning and design:-

When KSCC commenced the work, they faced unanticipated foundation problems. This was due to the foundation design based on erroneous data furnished by the agency who did the soil investigation. When this fact was noticed, the Project

Manager of KSCC brought this matter before the P.W.D. Engineers and the entire design was got revised in the light of a fresh soil investigation got carried out by a reliable firm. On account of this much delay was caused. Thus accuracy and correction of input data is important as any dilution or deviation can lead to avoidable delays.

2. Delay in getting designs and decisions:-

The architectural and structural designs were prepared by the concerned wings of the Kerala P.W.D. But drawings were not issued in time to KSCC. This has caused delay according to the Project Manager.

Similarly much delay was caused to the project implementation due to the bureaucratic attitude of certain officials in the decision making process.

3. Delay in issuing departmental materials:-

According to the contract agreement cement and steel had to be issued by the PWD to the KSCC. But PWD could not make the prompt supply of these departmental materials, especially when shortage occurred for the cement. This was one of the reasons for the project overrun.

4. Intermittent power cuts:-

Intermittent power cuts (load shedding) imposed in the state during the project period caused delay.

5. Inadequate Budgetary support:-

This was the main reason for the inordinate delay caused for the completion of the project. The cash flow was dependent on the Budget Provision each year. The work did not progress according to the planned schedule due to the delay in getting required funds.

6. Frequent changes of contractors and consultants:-

Lack of co-ordination in the early period among contractors, consultants and clients lead to considerable delay.

7. Frequent transfers and postings:-

During the project period of 12 years 9 Nos. Managing Directors were posted in KSCC. Even if much interest was taken by certain managing directors. they could

not do justice to the smooth execution of the project since there was no fund flow as required.

### **5.1.1 STRONG PROJECT TEAM AND LEADERSHIP**

Various activities in Project Implementation can be performed effectively and efficiently, only when there is a strong project team and leadership.

During the last two years of the project period in the case of Legislature Complex, Govt. of Kerala was committed to complete the project so as to inaugurate the Assembly Building in connection with the Golden Jubilee Celebrations of the Independence. Due to the political will to complete the project, adequate fund was allotted. During this period, an emergence of a strong project team and leadership can be noticed. The Managing Director of KSCC took the role of a Project Leader himself rendering meticulous attention for the speedy execution of the project and for the early completion of the project. There was absolutely no delay in decision making process. He got adequate support from his superiors. Weekly site meetings at the level of MD were convened to review the progress of work. Delays and short falls in any area were critically reviewed and immediate action was taken to improve the performance by the agencies who failed to keep up the schedule.

Payment position to contractors was also reviewed by the M.D and necessary instructions were issued to the concerned sections for expediting the payments of the bills, so as to keep the continuity of the work by the contractors at the project sites.

During the last 3 months of the completion of the project, daily meetings with officers, contractors and consultants at site were convened by the M.D. to review the position of:

- ➡ Progress of work
- ➡ Receipts of materials at site
- ➡ Critical areas needing immediate attention.

A High Level Committee involving the Speaker and P.W.D. Minister used to meet very frequently to oversee the progress of the work, during this period. Thus the project was completed and inaugurated by the President of India in May 1998.

### **5.1.2. PERCEPTIONS OF THE SUBORDINATES**

It is an accepted fact that effective implementation of project is dependent on the project leaders. What we really need is the able, efficient, committed and dedicated project leader for any successful implementation of a project. Various aspects of style of functioning and traits of the project leader was probed through the interviews with him and his subordinates:

1. Sense of urgency was lacking among the team members in the initial stages.
2. Change over period and the immediate impact:
  - i. became aware of the need for completing the project.
  - ii. neither optimistic nor enthusiastic.
3. New project leader indicated the time-bound nature of the project.
4. The new project leader succeeded in providing:
  - a) Conviction
  - b) Clarity of objectives and time factor
  - c) Clear communication at all levels
5. The new project leader brought in a qualitative change with:
  - a. Frequent meetings for review and planning
  - b. Leader acted as a facilitator
  - c. Timely decisions
  - d. Feeling that the leader enjoyed the support of higher level officials
  - e. Feeling that the leader will support the subordinates even if they go wrong in genuine cases which was missing in the early phases of the previous leaders.
  - f. Feeling that new leader was taking strong action against indiscipline by his power and influence.
6. Immediate subordinates felt enthusiasm than fear.  
At lower levels subordinates felt both enthusiasm and fear.

At lowest level there was a fear complex.

7. An awareness among team members that the new leader is aware of everything in detail.
8. The project leader was physically present as and when required.
9. He supported and encouraged the members to take independent decisions.
10. Enthusiasm was maintained without ups and downs.
11. The project leader succeeded in bringing in unity and team spirit among the colleagues and subordinates.
12. The administration staff was not as enthusiastic as the project team but afraid of the power and influence of the new leader.
13. The junior engineers or officers were taken into confidence and were involved in decision making.
14. A healthy, conducive environment and the tempo were maintained with police interference if necessary.
15. Convening the meetings of local leaders, officers, other departmental officers etc. had positive effect.
16. Sub contractors who initially resisted speed - had to accept the changes later.
17. Sub-contractors feeling of power and influence at higher levels dwindled, they became more cooperative.
18. High level committee was perceived as very powerful.
19. Fear
20. Team members felt relaxed during the last stage with a feeling that they had achieved the result.
21. Transparency in all dealings (members did not perceive any motive in him except completion of work) was a major factor for completion of work.
22. Project leader was not autocratic and was willing to listen. But he was not prepared to abdicate responsibility and took decisions only after thorough discussion on all aspects. If the decision of the leader was different he explains with facts and figures and convinces the other members.
23. Subcontractors and labour contractors were encouraged by prompt payment and supply of materials in time.

24. Follow up action based on review and re-planning sessions by the officers forced the subcontractors to complete the work in time.
25. Problems of labour solved through conferences.
26. High morale and enthusiasm without expecting additional reward or fear of threat.
27. Ad-hoc decisions were minimum most of the decisions were after deliberations but without undue delay.
28. There was resistance to the daily meeting in the initial stages but became a pleasure in due course.
29. Changed conditions created a confidence that the target could be achieved soon.
30. Engineers observed that they would like to continue as a member of the team if the same conditions and climate prevailed.
31. Subordinates became confident that they can now take decisions for the project leader will always support them for such independent decisions.

## **5.2 DISCUSSION ON THE IMPLEMENTATION ON INTERNATIONAL STADIUM PROJECT AT COCHIN**

The construction of the International Stadium at Cochin was commenced in April 1994 with a time of completion of 365 days from the date of handing over site. Though foundation stone of the stadium was laid on 27<sup>th</sup> March 1994, the site required for the commencement of the work could be formally handed over to the contractors only on 17<sup>th</sup> April, since land was in the possession of KWA with their storage sheds. Since the contractors had mobilised the machinery before that, they could commence the work of piling as soon as the site was handed over formally. Though the contractors had installed about 30 piling rigs, the expected progress could not be achieved since the unprecedented rain continued for 7 months. So the work was not completed within the 365 days. It took 515 days to complete the work.

Considerable delay occurred to get the land from Kerala Water Authority. That was one of the reasons to postpone the construction of the roof. Due to the deletion of roof from the purview of the contractors, the contract amount was reduced to 64.71

crores from the original contract amount of Rs. 73.32 crores. When the work is completed (without roof) the total cost of construction worked out to Rs 63 crores. It was due to the dedication and good team work that GCDA could implement the project within a limited time of 515 days. Perhaps, in the history of Kerala, this may be first time to complete a mega project like this within a record time of 515 days. The slippages in targets and Government's inability to pump in adequate funds for completion of big project like Kallada, Karapuzha etc. in Kerala have resulted in a big drain on the State's exchequer due to the escalation of the cost of each projects eight to ten times the original estimate. In this context, stadium project is an exception. The time overrun is also meagre. If monsoon had not continued for seven months as unprecedented and had the Water Authority land got in time as expected, perhaps there would not have been any time over-run for this project. In this project cost over run is not there. For the success of this project implementation, many factors contributed to it. Absolute, meticulous planning was there from the conception stage to completion. From a construction management point of view, the casting of the frame for the structure gave a lead-time during which period the pre-cast members could be kept ready. PERT chart was there for the control of the progress of work. Periodic revision of the PERT was made when the extension of the time of completion was granted. Daily site meeting with the client, architect, contractors and sub contractors, was there. It was very effective. If there was any problem concerning the work, it would be discussed in the meeting and the problem could be solved. The board put up on the Highway side just opposite the stadium site to display the number of "days remaining for completion" attracted public attention when the work was going on. The stadium which was completed in a record time without a single manday having been lost on account of strike has a larger message for Kerala. It is that the bureaucracy in the state can measure up to any challenge and that any public undertaking can do wonders if it has a committed and dedicated team. Modern innovative techniques were used in the project. For example, SOKKIA SET ZC II popularly known as INTELLIGENT TOTAL STATION was used in the survey work for piling. This zero error equipment saved precious time and man power. Similarly, for the first time in the history of Kerala, Dynamic load test (Non-Destructive) which is a hitech testing method for piles, was carried out to predict static bearing capacities of piles. Strict Quality Control was ensured in various stages of construction. While designing the stadium, an eye for



optimum utilisation of space under the galleries into commercial areas was also kept in mind. Since different contractors were engaged sector wise, the pace of construction was much faster as compared with traditional system of one contractor. An element of completion in completing the work among the sub-contractors contributed positive results in achieving the good. Right sub-contractors had been chosen for the job by HSCL. Uninterrupted supply of materials especially a bulk quantities of cement and steel could be ensured. Engineering was carried out as a parallel acting to construction. Design of the pre-cast pre-stressed concrete structure was integrated with fast construction methods and a high degree of mechanisation.

### **5.2.1 PERCEPTIONS OF THE CONTRACTORS**

If the contractors feel that the project leader is competent and committed to work with a high degree of integrity, they will not approach higher- ups to get favoures. It is clear that the project leader has to play important role in almost all the functions of construction management for productive performance. From the perception of the contractors the traits of the project leader will be revealed. The perceptions are as follows:

Experienced differences in comparison with other works:

1. Received all facilities
2. Physical presence of the officers at work spots.
3. Prompt payment on completion of work
4. Supply of materials on the spot
5. Prompt decisions without complications.
6. There was no labour dispute at all.
7. Technical support by developing new methodology for solving technical problems which reduced complication and consequent saving in time.
8. Project leader was perceived as good; contractors were only happy to do the work under him.

### 5.2.2 DANGERS FROM UNBALANCED PROFIT DISTRIBUTION

Basic investment of a contractor is the trade price of material to be purchased by the contractor, wages of the labourers including overtime for labour, expenditure to be incurred on equipment, plant, machinery, expense on infrastructure including arrangement of water and power etc. i.e. actual cost (without contractor's profit) will be the basic investment of a contractor.

In the Kerala PWD data, only 10% is allowed towards contractor's over heads and profits. Generally, major contractors work on a margin of 20% to 30% in their rates towards over heads and profits for major works. For time bound works and turn-key projects of high magnitude involving complex construction methods with minimum construction period, call for heavy equipment heavy plant and machinery, such as a number of high capacity cranes, batching plants, site laboratory, transit mixers, concrete pumps, dumpers, tippers, compressors, generators etc. Also, a large labour force will have to be engaged and round the clock work without holidays will also become necessary. Some times, a number of specialist works such as pre-cast and pre-stressed concrete works will have to be done. Considerable expenditure will have to be incurred by the contractor for setting up casting yards, steam-curing etc. The contractor has to invest heavy amounts on equipments, plant and machinery and also incur expenditure on overtime for labour, which will also involve heavy investment on infrastructure.

In certain cases, the tender condition will stipulate that all materials including cement and steel have to be procured by the contractor and there will not be departmental supply of materials. The tender also stipulates that in the case of cement and steel, basic prices are to be taken and that any fluctuation during the currency of the project in the price of all materials including cement and steel as well as of fluctuation in labour, transport, taxes, duties etc. will have to be borne by the contractor within his quoted rates.

Similarly, the contractor will also be given the responsibility for all major infrastructure, in particular, arrangement of water and power at his own cost.

On account of the above factors, the allowance of 10% towards over heads and profits, as per the KPWD schedule of Rates practice will not be followed by the contractors while quoting the tenders. It is more likely for the contractors to adopt 25% to 30% towards this. In general, the tenders received are higher than the KPWD schedule of Rates by about 25% to 30%.

To give an idea of the range of quotations, the following items can be seen in Table 5.1, with reference to the quotation for the construction of International Stadium at Cochin.

**Table 5.1 : The Extent of Fluctuation for normal items**

Item No.	Particulars of work	Estimated Rate	Lowest Rate	Highest Rate
B1 of GBW	CC 1:4:8	Rs 739/Cu.m	Rs 909/Cu.m	1801/- Cu.m
B2 OF GBW	CC1:3:6	Rs.943/Cu.m	Rs 1052/Cu.m	Rs. 2055/-
B4 OF GBW	RCC 1:2:4	Rs.2352/Cu.m	Rs1815/	Rs.4892/-
C1 OF GBW	Brick work upto G.L	Rs 682/Cu.m	Rs.1164/	Rs 1563/
C2 OF GBW	Brick work superstructure	Rs. 702/Cu.m	Rs1214/-	Rs.1783/-
C3 OF GBW	Half Brick partition	Rs.133/-	Rs.180/-	Rs. 372/-
	Total of Brick work	Rs.67.77 lakhs	Rs.115.35 lakhs	Rs. 169.35
E1 OF GBW	Grano	Rs.65/-	Rs.80/-	Rs.153
E8 OF GBW	Heritage for Exterior	Rs.326/-	Rs.292/-	Rs.781/-
14	Ceramic Tile Dado	Rs.390/-	Rs.408/-	Rs.639/-
15	Adanga Marble	Rs.659/-	Rs.981/-	Rs. 1430/-
24	Flagstone paving	Rs.240/-	Rs.286/-	Rs.544/-
	Steel Reinforcement	Rs. 15705/-	Rs.19450/-	Rs.23175/-
G1 OF GBW	Aluminium Doors	Rs.2430/-	Rs 2904/-	Rs.4076/-
G4 OF GBW	Aluminium Windows	Rs.1820/-	Rs.1811/-	Rs.2162/-
	Total of Aluminium works	Rs.37.78Lakhs	Rs.41.32 Lakhs	Rs 51.97 Lakhs
	Total of Plaster	Rs.24.56 Lakhs	Rs.36.19 Lakhs	Rs.67.81 Lakhs

The above table is only to indicate the extent of fluctuation for normal items of building and also finishing items. Even the firm which quoted the lowest tender in the overall total, have quoted very high rates under the Finishing and normal items of GBW. The comparison statement indicated the scope for discussion with the tenderers.

As an extension of the above logic, when it is particularly observed it showed that the highest tenderer has quoted the lowest among the four under various sub-heads, such as the General builders work, Ramp entrance, substation, Underground Sump, Pump room, Ticket booth, roads etc. Under many of these heads, another firm had quoted closer to the highest. Likewise, taking special service items into account, the estimate for these items comes to Rs.11.80 crores. If we consider the lowest subtotal for each item among the four, the total comes to Rs12.32 crores, which only indicates a marginal increase. On the other hand, individual total for these items by one firm who is the lowest tenderer, comes to Rs14.74 Crores for these corresponding items. On account of the wide fluctuation of the rates quoted by the four tenderers, GCDA has prepared a statement which gives the following format.

Sl.No.	Particulars of Work	Estimated Amount	Lowest Tendered amount Item wise
--------	---------------------	------------------	-------------------------------------

By considering the above aspect, it can be seen that the total estimate is Rs. 58.03 crores against which the grand total of the lowest tendered amount alone comes to about Rs 63.08 crores (i.e. 9% above). Taking the above factors into account, GCDA came to the conclusion that if negotiations are conducted, substantial reduction is possible and that is how negotiation with M/s HSCL, the Government of India Company, was carried out. After negotiation, the tendered amount of Rs. 76.98 crores was reduced to Rs. 73.32 crores

Thus overall project profit/margin to HSCL works out to  $Rs\ 73.32 - 58.03 = Rs\ 15.29$  crores which is 26.35%. But the actual profit/margin at various stages of work may not be uniform as the overall profit/margin. From the discussion above, one could see the fluctuations of rate for various items of work. Thus if one analyse the rate of various items he can find different percentage of profit/margins. That is, the running

profit/margin or item wise / stage wise profit/ margin will be at variance with the overall profit/margin. From the payment details (Table 5.2) the profit/margin at various stages of payment in respect of the construction of International Stadium are as follows.

**Table 5.2 Details of Payment of Civil Works to Contractors**

Period of payment (3 month)	Estimated amount of work Rs. in crores	Value of work done with reasonable profit Rs. in crores		Value of work done with front loading effect (Amount paid) Rs. in crores	Percentage profit quarter wise
1 <sup>st</sup> quarter	6.92	10%	26%	11.07	60%
2 <sup>nd</sup> quarter	5.42	5.96	6.83	8.40	55%
3 <sup>rd</sup> quarter	7.91	8.70	9.96	11.86	50%
4 <sup>th</sup> quarter	6.34	6.97	7.99	8.68	37%
5 <sup>th</sup> quarter	6.45	7.10	8.13	8.26	28%
6 <sup>th</sup> quarter	3.47	3.82	4.37	3.99	15%

Thus, from the total payment of Rs. 52.26 crores made for civil works, the percentage of profit/margin works out to 43.14% Again from the total payment of Rs 10.27 crores for electrical works, the percentage of profit/margin works out to 45.30%. Thus from the total payment of Rs. 62.53 crores made to m/s HSCL for both civil and electrical works, the overall project profit/margin works out to 31.01% as against the overall initial project profit/margin of 26%. If the tender of the successful tenderer is balanced in relation to the Engineer's estimate of the real cost of the work to be performed under the contract, the profit/margin will be balanced and hence the distribution of profit will be ideal. In such a case, the items of the work will be reasonably priced. No item will be heavily over priced. There will not be much variation of profit at various stages or items of work. The overall project profit/margin will be more or less same at various stages of payment.

If the tender of the successful tenderer is unbalanced or front loaded, the distribution of profit will also be unbalanced. This happens mainly due to the strategy or tender jugglery resorted to by the tenderer when offers are given. In the case of contract of International stadium it can be seen that the first 4 items costing about 78% of the value of work has been heavily over priced by the contractors. That is, the tender was seriously unbalanced or heavily front loaded. In that case, the distribution of profit will also be unbalanced. We found that, when payment of 11.07 crore is made, the percentage of profit margin is 60% when 8.40 crore is paid, the profit margin is 55%. But, when at 6<sup>th</sup> quarter payment of 3.99 crores, the profit margin was 15%.

#### **5.2.2.1 PROFIT CURVES**

Fig. 5.2.2.1 is the curve based on the quarterly payment. It is a graphical representation of the front loading contract. The parallel line indicates the 10% and 26% profits respectively. The profit curve at various stages of payment is also shown.

Fig. 5.2.2.2 is the profit curves of actual amount invested and profit/margin received. Since the overall project profit/ margin remains the same i.e. 26% the curves are parallel. Fig. 5.2.2.3 is the curve based on the investment and payment.

Fig. 5.2.2.4 is the profit curves indicating 10%, 26% and stagewise profit/margins. It depicts clearly the effects of front loading contract. The main 4 items are heavily overpriced making the contract front-loading.

Fig. 5.2.2.5 is also the curve showing the front loading and rear-loading contract. The negative area (with minus sign) shows the effect of rear-loading contract. Here the profit/margin of the contractor will be less since the quoted rate in this zone will either be reasonable or less.

### 5.2.2.2 COEFFICIENT OF UNIFORMITY IN PROFIT DISTRIBUTION

With respect to the profit curve, the ratio of the area of the front portion to the area of the rear portion can be termed as Coefficient of Uniformity in Profit Distribution.

$$\text{i.e. Coefficient of Uniformity} = \frac{\text{Front Portion}}{\text{Rear Portion}}$$

Front portion will be the area for the half of the project duration and the rear portion will be the area in the second half.

### 5.2.2.3 CLASSIFICATION OF PROFIT CURVES

The profit curves can be classified based on Coefficient of Profit Distribution. If the coefficient of profit distribution is 1, the tender or its contract will be balanced.

$$\text{ie } \frac{\text{Front Portion of the profit curve}}{\text{Rear Portion of the profit curve}} = 1.0$$

If the coefficient of profit distribution is greater than 1, the tender or its contract is said to be unbalanced. If the coefficient of profit distribution is less than 1, again the tender or its contract will be unbalanced. Thus the Coefficient of Uniformity of Profit Distribution is an indicator as to a contract is balanced or unbalanced. From the coefficient we get an idea whether the pricing on the items of the work by the contractor is reasonable or highly priced.



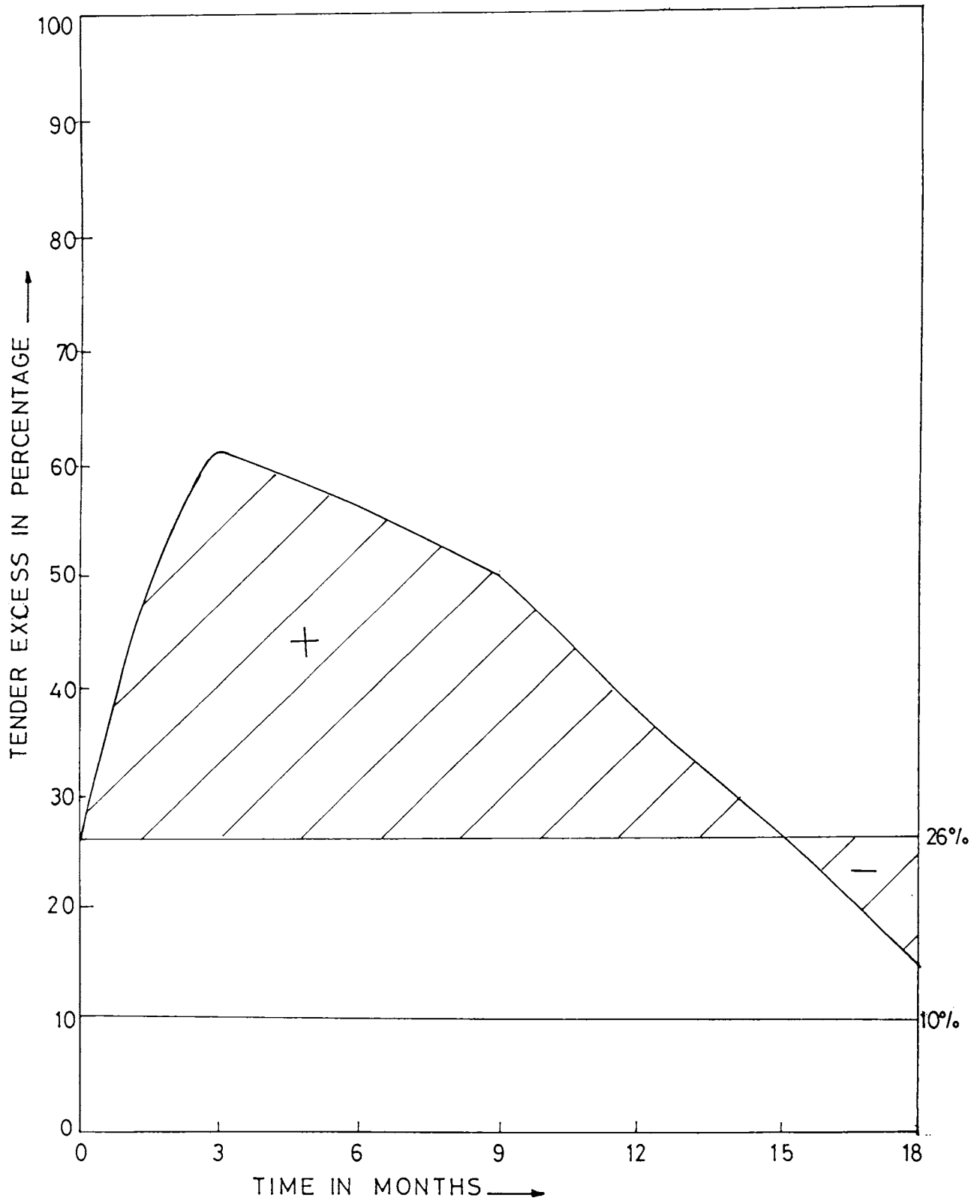


Fig. 5.2.2f CURVE BASED ON THE QUARTERLY PAYMENT  
IN THE CONSTRUCTION OF A STADIUM AT COCHIN

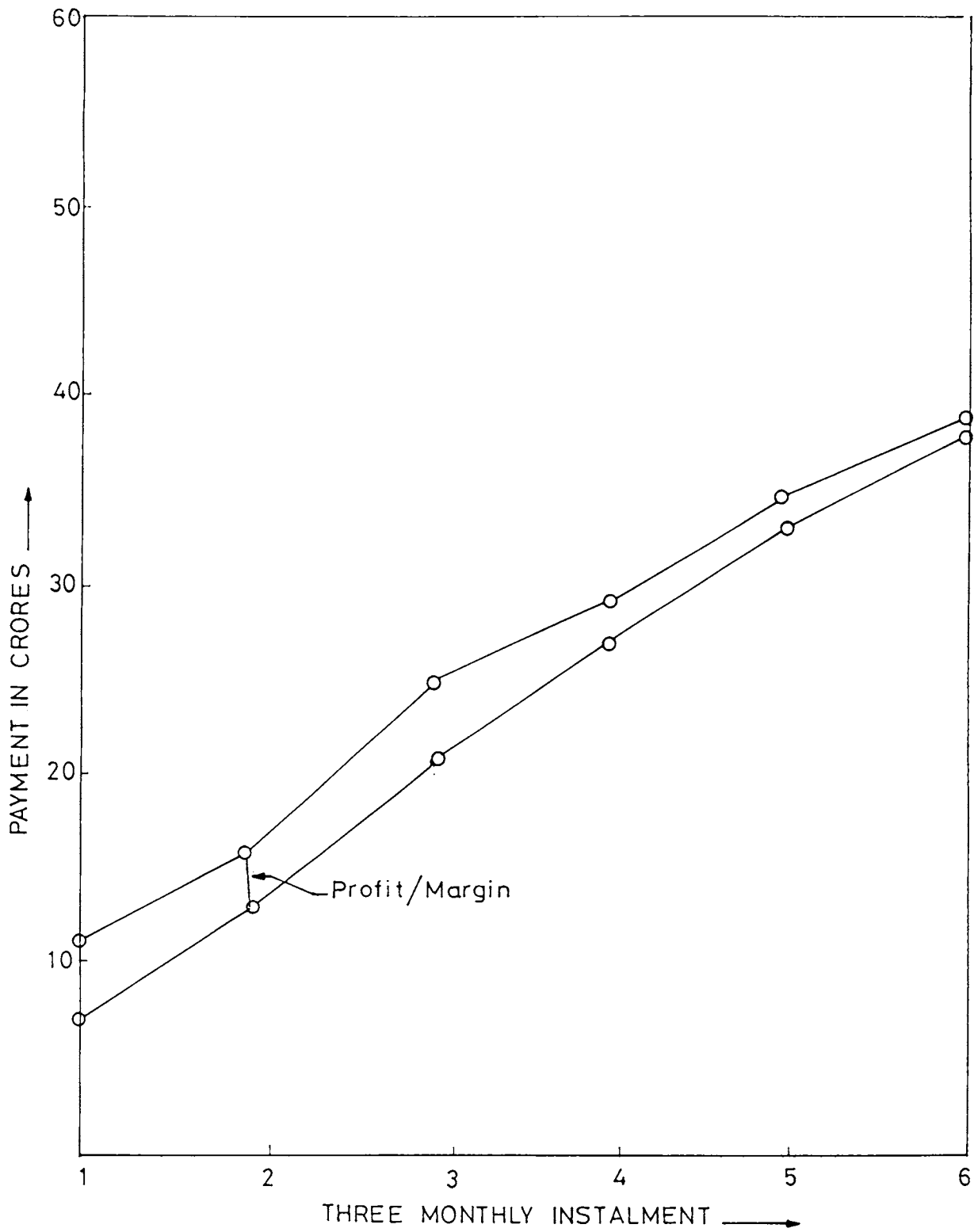


Fig. 5.2.2 CURVE BASED ON THE PAYMENT (SHOWING THE PROFIT/MARGIN)  
A STADIUM AT COCHIN

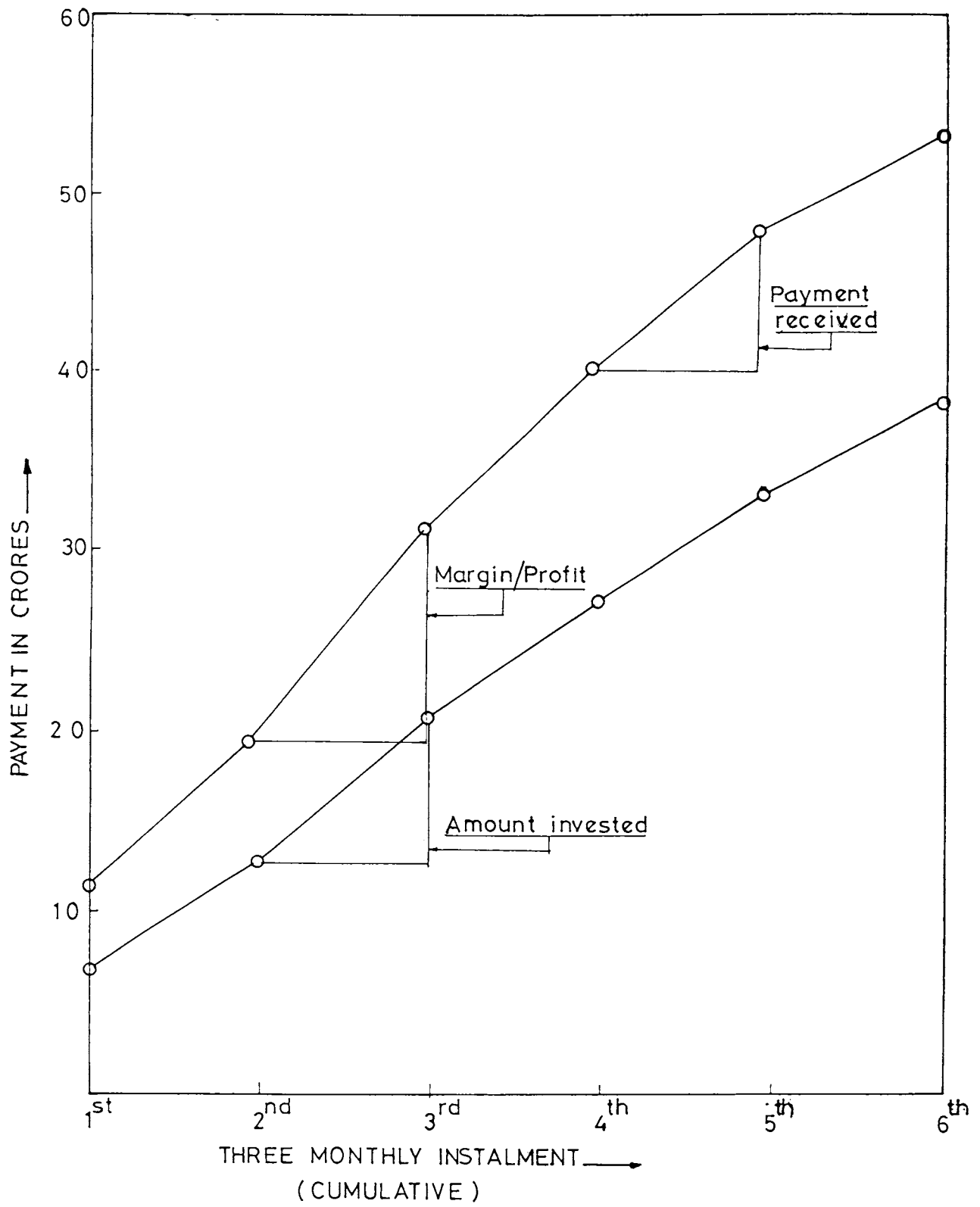


Fig. 5-2-23 CURVE BASED ON THE QUARTERLY PAYMENT  
 (INVESTMENT AND PAYMENT CURVE )  
 A STADIUM AT COCHIN

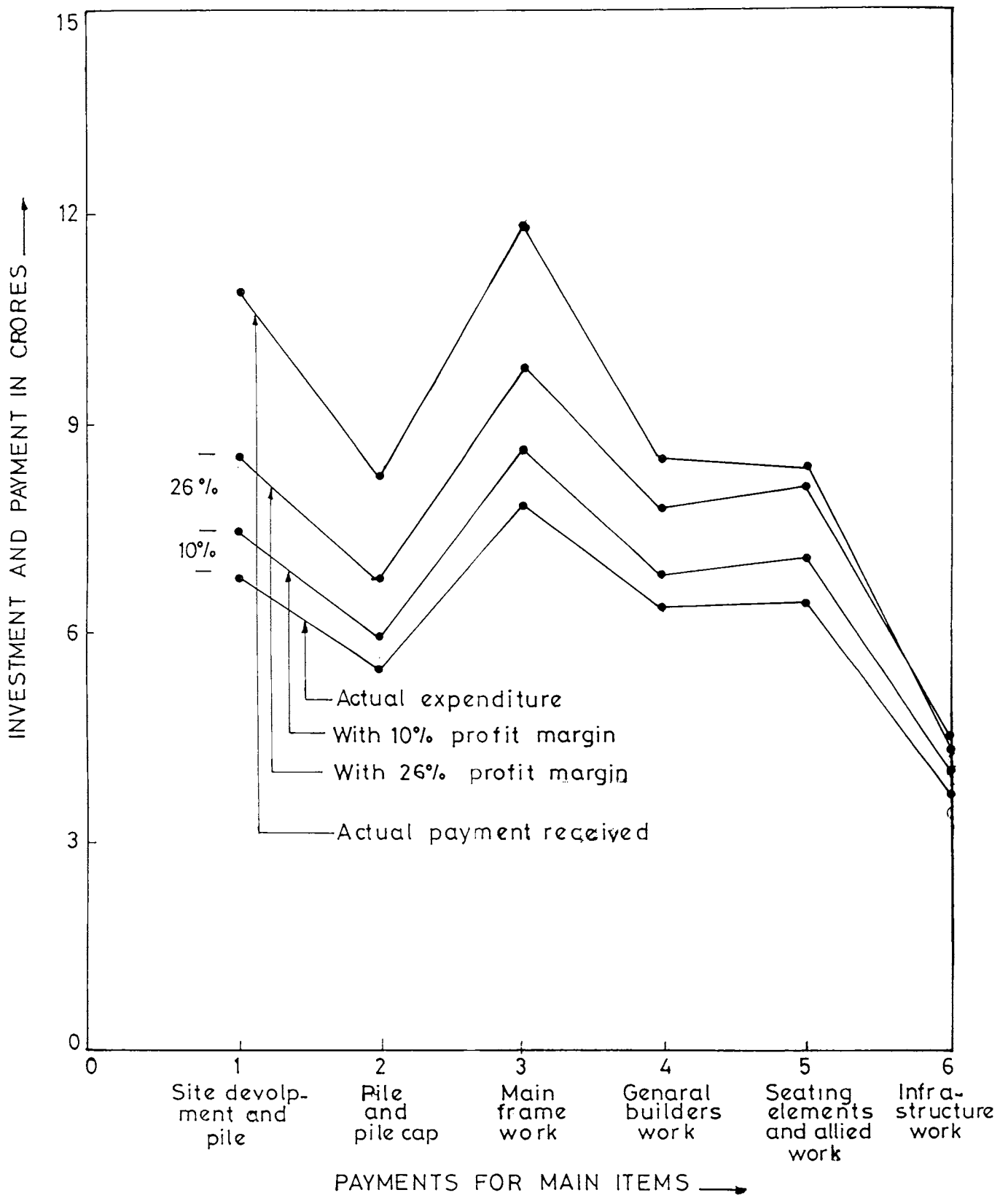


Fig. 5.24 PROFIT CURVES - A STADIUM AT COCHIN

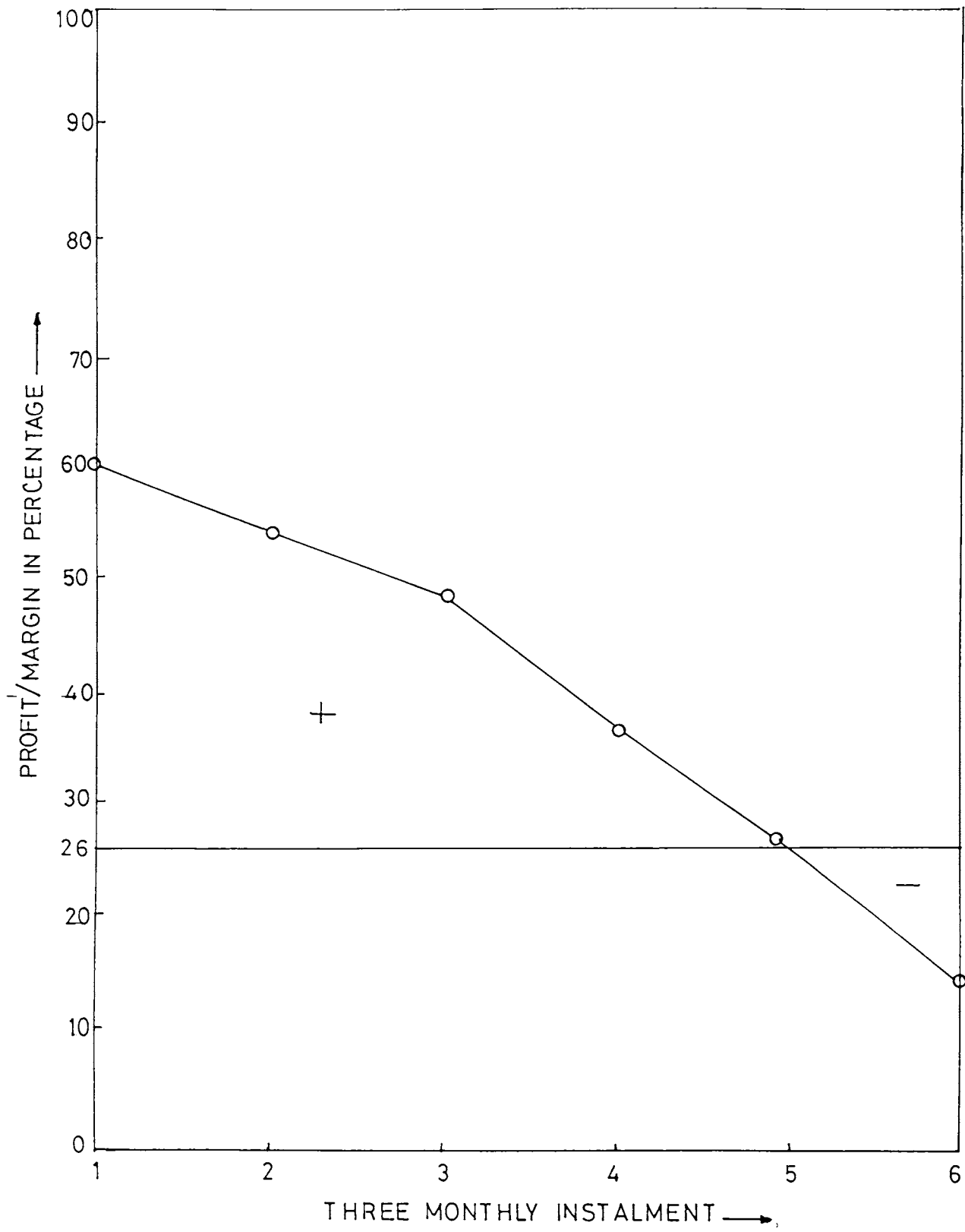


Fig. 5.2.25C CURVE SHOWING FRONT/REAR LOADING EFFECT OF THE CONTRACT— A STADIUM AT COCHIN

This information is very useful and vital to an employer while finalising a contract with successful tenderer.

Contractor-friendly profit distribution: -

If the contract is unbalanced, rather highly or heavily priced, the profit from the contract to the contractor will be more and hence it will be contractor - friendly. Depending on the magnitude of Coefficient of Uniformity in Profit Distribution, it can be adjudged whether the profit distribution is contractor - friendly or not. If the CUPD is greater than 1, the profit distribution will be contractor - friendly.

#### **5.2.2.4 EMPLOYER - FRIENDLY PROFIT DISTRIBUTION**

If the coefficient of uniformity in profit distribution is less than 1, the profit distribution will be employer - friendly i.e. In this case the area at the rear portion of the curve will be more than the front - area. The pricing of the items by the contractor will be advantageous to the employer. At the tender stage itself, the employer - friendly profit distribution can be detected. At first, the employer will be glad in getting an employer - friendly tender. But things will not move as he feels in all cases. There is some risk involved in the case of employer -friendly contract. In the tender, the contractor may price the items of work with the intention of becoming the lowest tenderer. i.e. He might have under quoted to grab the contract. Or, he might have under - quoted unknowingly since he may not be conversant with the current market prices. In both the cases, an element of risk is present. A contractor will not be willing to execute an unprofitable work. But, if the contractor executes the under - quoted work, the profit distribution will be employer - friendly. It is always better to have a balanced contract, i.e with reasonable profit to the contractor throughout the work. That will be more employer -friendly rather than profit distribution being employer - friendly.

### **5.2.2.5 POSSIBLE MANIPULATIONS FOR FRONT LOADING BY CONTRACTORS**

As we have seen earlier the first 4 items costing about 78% of the value of work has been heavily over priced by the contractors of the International Stadium. That is, the tender of the successful tenderer was seriously unbalanced or heavily front-loaded. This phenomenon is one of the strategies or tender juggleries resorted to by certain contractors when they give their offers. But for the first main 4 items, the rates for the remaining 18 items of work were reasonable or under quoted. The logic behind this is that by resorting to the front loaded tender, the bidder will become lowest and the work will be awarded to him/them. When the work is awarded, the contractor will try to change the under quoted items to suite in his favour or try to avoid those items of work. By doing the heavily priced items of work, the contractor will get the lions share of the money. If the contract is front loaded, the client's interest will be at stake. The client has to invest more money at the beginning itself. The interest burden of the money paid to the contractor has also to be considered.

In the contract of International Stadium, the rate for pre-cast tier elements was very low. But, subsequently that item had to be changed to pre-stressed seating elements by converting it as an extra item. The rate for this item was higher and beneficial to the contractor.

The gravity of the front - loading has to be detected as soon as the tender is opened by the employer. A lesser contract amount need not necessarily mean advantageous to the employer. The risk involved in the front-loaded contract is very high.

### **5.2.2.6 ROLE OF COEFFICIENT OF UNIFORMITY IN PROFIT DISTRIBUTION IN THE SELECTION OF CONTRACTORS:-**

The Coefficient of Uniformity in Profit Distribution plays a very important role in the comparative study and selection of contractors. The CUPD is an indicator in adjudging a front - loaded contract. The front loaded contract can be classified based

on coefficient of uniformity in profit distribution obtained from profit curves. If the magnitude of CUPD is 1, the contract will be balanced. If CUPD is between 1 and 2, the effect of front - loading will be tolerable. If it exceeds 2, it will be detrimental to the interests of the employer and it is better not to award the work to that contractor.

#### **5.2.2.7 METHODS OF REDUCING THE RISK OF FRONT - LOADED CONTRACTS**

Three methods are suggested to circumvent the adverse effects of front - loaded contract. They are :

- (1) Levelling of contract:- A levelling of the cost of the tender can be carried out before accepting any tender, so that the rates can be brought to workable rate. At present, there is no clause or condition to this effect in the PWD system of contract. This clause has to be introduced.
- (2) In major projects, a clause of performance security has to be included. The clause shall be that the successful tenderer shall furnish to the Employer a performance security in the form of Bank guarantee for an amount equivalent to 10% of the contract price in addition to the normal Security Deposit of 10% of the contract amount.
- (3) If the tender of the successful tenderer is seriously unbalanced in relation to the engineer's estimate of the real cost of the work to be performed under the contract (as determined by the engineer) by more than the amount of the performance security, the employer may require that the amount of the performance security set forth in the clause above be increased as the expense of the successful tenderer to a level sufficient to proceed the employer against financial loss in the event of the subsequent default under the contract.

### **5.3 DISCUSSIONS ON THE IMPLEMENTATION OF COCHIN INTERNATIONAL AIRPORT AT NEDUMBASSERY**

Rs. 230 crore International Airport, the nation's first such venture with massive financial participation from the public, stands with all its splendor at Nedumbassery.



The construction of this ambitious project had started five years ago, amidst widespread scepticism, financial uncertainties and land acquisition problems coupled with political squabbles. But the massive financial participation and the support and good will of the public helped the project works progress fast and helped the state realise its dream of having a full-fledged international airport.

"Even in developed countries, the construction of an airport of this scale used to take at least 10 years for completion" said the Managing Director of the Cochin International Airport Ltd. The project's progress was an excellent example of how people could lend helping hand in triggering the development of a state.

However, when things started moving, the acquisition involving 400 families from their age-old land became a major impediment. The people of Nedumbassery had set an excellent example before the nation of how people should sacrifice their interests for a greater cause.

The NRI passengers, mainly from the Gulf were badly in need of a direct landing centre in a central place in Kerala. Now, the air travel has become easier for the thousands of NRI's sailing from all over Kerala especially from state's central districts.

The first plane (Dornier, part of the AAI's flight calibration units) landed at Nedumbassery on 12<sup>th</sup> May '99. The airport, the first of its kind in the country to be constructed and owned by a state Government promoted company, was inaugurated at Nedumbassery by the President of India on 25<sup>th</sup> May 1999. It has become operational from 10<sup>th</sup> June 1999 with the launch of Air India's regular flight operations from there.

The starting of domestic flight operations from 1<sup>st</sup> July '99 marked the culmination of the process of making the airport passenger terminals fully functional. Though the international terminal became operational when Air India's operations commenced at Nedumbassery from June 10, the number of services from the airport have substantially gone up now with the addition of the domestic flights.

The operation of a Boeing 747 was witnessed for the time in the state when air India's Jumbo jet began services from the Cochin International Airport at Nedumbassery on June 21, afternoon. More than the passenger traffic, the Nedumbassery Airport was planned as one to facilitate large scale cargo movement which could give a boost to the economy of this state. The major chunk of the airport's revenue is expected from cargo traffic, mainly fruits and flowers, which are emerging as a major export business in South Indian States. The refueling setup at the airport is also likely to be a major source of income, as the new strategically located on the international air map.

The project was delayed mainly due to two reasons, one being the delay caused in the acquisition of land and the other heavy rain during the year 1996 and 1997.

### **5.3.1 A REVISION IN THE LAND ACQUISITION ACT NEEDED**

The land acquisition of about 1300 acres in two phases for the runway and the terminal buildings and other facilities had thrown up quite a few problems, being mainly social problem, since it involved the displacement of thousand of people. It was a turbulent phase for both the landowners and those involved in project implementation

There are several problems posed by the 105 - year - old Land Acquisition Act (LAA), 1894. Most projects are bogged down in litigation over compensation. While cash gets spent on conspicuous consumption, poor persons with less assets end up with less compensation. Since the LAA compensates assets, and not livelihood, oustees are vulnerable to the trauma of uncertainties and delays. Many people become "panperized" by the development process.

So, a people-friendly Land Acquisition Act has become vital and urgent. Otherwise, a major revision can be brought in the present Act that will support speedy and planned growth of industrialization and urbanization, apart from factoring components like liberal compensation and a uniform national policy on rehabilitation and resettlement of affected families. It should envisage increase in compensation, reduction of delays caused by disputes over claims, tackling of resistance from oustees

to the acquisition and more importantly, ensuring that the rehabilitation package reaches the beneficiaries in time. The revision must be in such a way that it must seek to compensate people for "loss of livelihood" apart from changing the basis for assessment of compensation - highest of sale deed, scheduled rates and annualised production. The solatium can be increased from 30 percent to 100 percent. First payment can be made within two months of declaration and complete acquisition can be made only after full payment.

The affected persons can be regarded as "share holders" in the development project for which the land is acquired. Apart from providing employment or sources of employment, the Act or Revision must envisage providing benefit to the affected person. Makeshift dwellings and monthly allowance, provision of alternative house sites etc should be provided. Comprehensive settlement and rehabilitation of persons affected by compulsory acquisition of land are also to be incorporated.

The Revision or the people - friendly Land Acquisition Act would settle permanently the dispute and will also ensure timely completion of acquisition of land by the project implementing agency, the State Government and the district administration.

### **5.3.2. FACTORS BEHIND THE SUCCESS STORY**

The analysis of the factors for the successful achievements shows that:

1. CIAL was always headed by a committed dedicated, efficient and capable project leader.
2. The weekly meetings at the office and site were found to be very effective as part of monitoring and control mechanism.
3. Well formulated and tested guide-lines on contracts and project implementation were followed.
4. During the weekly site inspection of the MD, he talked with all site staff irrespective of the hierarchy and the contractors and tried to understand every problem and their views on it.

5. The continuity in the project activities enabled the project leader to develop a good project team with the latest technology and experience.
6. The project Leader motivated a sense of urgency in getting things done by his staff by brain-storming and extracted the work from them.
7. There had been a good succession planning at all levels of senior executives.
8. Organisation always enjoyed the advantages of an experienced consultants.
9. In the meetings, the M.D. and the staff discussed all the programs, priorities, short falls, pending issues, sorted out all problems and took critical decisions, whenever it is needed.

The above main factors contributed much for the success story of the effective implementation of the project.

#### **5.4 ANALYSIS OF DELAYS IN PROJECTS**

A number of engineering project in the country especially in Kerala were examined for delays in completion and increase in costs. The main reasons for delays in the projects analysed in the chapter 3 are discussed here in detail.

The unique Metro Railway Project in Calcutta was delayed badly due to the labour strikes. The contract labourers apprehended that when the project is completed, they would be retrenched. So the labour union was interested in extending the work as long as possible so as to enhance the employment prospects of the contract labour.

The Calcutta Metro, India's first underground railway, launched in October 1984 as a route from Esplanade to Netaji Bhawan, connects DumDum to Tollygunge since 1995. Like all other mass transit systems in the world, the Calcutta Metro cannot be financially remunerative. For the operation of such a system, subsidies to some extent are inescapable. It has resulted in enormous benefit to the public. It is expected to carry more than 5 lakh commuters per day when interval between trains is reduced to 6 minutes. It has earned appreciation from people both from our country and abroad for its pollution - free, safe, punctual and comfortable environment.

The Konkan Railway Project which took seven years to complete, makes its way through difficult and varied terrain across Maharashtra, Karnataka and Goa. Kerala is also a major beneficiary of the project with the State being connected with Mumbai via Mangalore.

Though the Konkan Railway Project was scheduled for completion by October 1994, it was completed in the month of January 1998. The project was delayed because of shortage of funds mainly. The Konkan Railway would bring with it the message of prosperity and for many more such infrastructure projects in the country through people's participation on a built, operate and transfer (BOT) basis.

When the 50 crore Jammu - Udhampur Railway Line Project was completed, the cost was increased to 250 crores. The project was dragged on for want of funds. That is the case with the stage 1 of Upper Krishna Project (UKP) in Karnataka too. Due to inadequate flow of funds, the project proceeded at a snail's pace in the beginning. Rs. 8,000 crores has been spent on the UKP project so far. It is expected that the project would be completed within one year. If enough fund had been allotted, this project would have been completed much earlier. The delay to get the technical clearance from the Planning Commission for stage III of the UKP is also one of the reasons for the cost overrun.

When the Kallada Irrigation Project was commenced in 1961, the estimated cost was Rs. 13 crores. It took more than Rs. 600 crores for the 1<sup>st</sup> phase of the project.

The Kallada project has turned out to be a black hole devouring Government funds. As many as 72 vigilance cases have been registered in connection with the Kallada Irrigation project contract scam. The accused officials had altered the contractual terms and sanctioned excess amounts to the contracts. Most of the vigilance cases are pertaining to collusion between contractors and Government officials.

KSEB has incurred a heavy loss on Kakkad Project as its commissioning originally scheduled for 1984 had been postponed more than thrice for various reasons.

The project work which started in the year 1980 was delayed many times following strikes by the workers as well as contractors. In 1995-96 the contractors had stopped the work for about one year following a struggle between KSEB and then on payment. The trade unions had adopted double standards on many occasion causing bottlenecks in the progress of the work. Once, the power tunnels drilled from the two ends went in two different directions due to the flaws in the survey. This alone has caused a delay of seven months.

From Kerala High Court's direction to the Kerala State Electricity Board to pay a compensation of Rs. 8.08 crores to the contractors (HCC) for delay in the execution of construction works of the lower Periyar Hydro Electric Project's power tunnel, it reveals that the delay has been caused due to the Board's actions. From the Court Judgement, it was clear that the HCC which had completed the major portion of the project was suffering from acute financial constraints due to delay in the completion of the project during May 1992. Here, it may be noted that the date of completion was September 26, 1992. The progress of the work affected due to the financial problem of the contractors. The project was commissioned only on 14<sup>th</sup> October 1999.

Karapuzha Irrigation Project in Wayanad district had started in 1978. It can be seen that the cost escalation is of the order of 2960 percent, with the original estimate of Rs. 7.60 crores shooting upto to Rs. 225 crores in 1997. The cost benefit ratio of the project was scaled down to 1:1 (minimum requirement 1:1.5). It shows that the project has become unviable. The work had been stalled owing to the delay in the acquisition of land and completion of investigations, inadequate provisions of funds and changes in the original design of the spillway. 250 hectares had been identified for the land acquisition. But 33 hectares only had been acquired till 1997. The reason stated by the officials for this is lack of surveyors and chair<sup>men</sup>. If government machinery was alerted to provide enough surveyors and chair<sup>men</sup>, the complete extent of land could have been acquired. According to the CAG, huge amounts from the project were diverted and utilised for some other purposes.

The investigations of the CAG found that 10 works estimated to cost 84.45 crores were awarded to two contractors under 103 piece work agreements, and that too

without inviting tenders. Only a rough cost estimate was prepared and work awarded at 25 to 50 percent above the estimate rates without inviting tenders. The CAG did not accept the Government's contention that the project cost would go up if it had been tendered, besides leading to delays. The Government's contention that the department stood to gain Rs. 30 lakhs a year by way of hire charges from the contractors for the use of its tools and plant was found to be baseless as the arrangement could net only Rs 6 lakhs. The department also awarded fresh works as extra items to the tune of Rs. 17 crores even though these should have been treated as incidental to the original work when it was being executed. Audit examinations revealed violations in the department manual relating to the revision of schedule of rates, separate rates for various kinds of works and wages.

The 2.5 MW Malampuzha mini hydel project, which was launched in 1989, would have been completed within a year if the works had progressed as per the schedule. The contract of this project was given to a private firm which had no previous experience in such projects. This was main reason for the delay. In this context, the selection of a contractor with proper experience is vital. While based on his technical competence, the contractor should be allowed to bid only for specified kinds or areas of work.

The Muvattupuzha Valley Irrigation Project has turned out to be yet another Kallada, devouring Government funds. The slippages in the targets and inadequate flow of funds for completion of this project have resulted in a big drain on the state exchequer due to the escalation of this project six times the original estimate. The political interference and official indifference has also brought inordinate delay in the completion of the work on the project. The estimated cost in 1980 was Rs. 48.08 crores. However, the cost had now gone up to Rs. 388 crores. The work had come to a standstill due to various reasons. The stoppage of work had also escalated the cost of this project. The Vigilance Department has unearthed more cases of irregularities in this project. Political stability and sound economic policies are essential for the successful completion of any major project. Recently, the Kerala High Court has said that it is for the State Government to decide whether the work on the Rs. 388 crore Muvattupuzha Valley Irrigation Project should be resumed or not. This is an indicator

wide vision. Before a project is taken up, its economic and technical viability shall be looked into. The cost benefit analysis has also to be worked out.

that we should do more homework before we undertake any project. We must have a wide vision. Before a project is taken up, its economic and technical viability shall be looked into. The cost benefit analysis has also to be worked out.

The construction of the 215 metre Kumbalangi - Perumpadappu bridge cost the exchequer Rs. 8.78 crores as against the original estimate of Rs. 1.5 crores over a period of 13 years. The construction history of the bridge is chequered with delays, changed contractors, stoppage of work and public agitations. The major reason for the delay of this project is inadequate allocation of funds in the State Budget. Delayed payments to contractors result in the slowing down of the project and eventually a complete stoppage.

In a move to simplify labour laws, the Government of India has proposed to amend the Trade Union Act of 1928. The idea is to make the trade union movement more effective and relevant with the participation of labourers in genuine issues rather than to allow politicisation.

To execute a project, four inputs are required; men, material, machinery and drawings. If any of these are not available the work comes to a halt. Idle wages and over heads add to cost. The plan and programme prepared, must detail the materials, man power, machinery and drawings required each month.

Cost control is essential. But no rigid formulae can be prescribed, as each job will determine the method to be followed. However, any project planned in advance, executed as planned, monitored regularly will result in the contract being executed within budgeted costs, within the stipulated time period and according to high standards of workmanship.

## **5.5 TIME OVER RUNS IN A PROJECT**

The three dimensional criteria for successful management of engineering project are based on time, cost and quality dimensions. The time dimension requires the completion of the project within the optimized target date.



It is noticed that the period of completion is decided at a lower level of technical hierarchy. There is no scientific or statistical basis for this assessment of project duration. If a method based on past experience of completed projects were evolved for assessment of time of completion, it would be possible to assess time more correctly. It is usually seen that time is underestimated initially. The users/ administrators/ politicians would expect quick returns for the investments made. Several case histories would show that the engineering authorities succumb to pressures and under estimate the period of completion. Usually when a project is scrutinized technically or financially at higher levels, the aspect of optimized completion time is not given the attention it deserves.

Time overruns are mainly due to:

1. Delay in taking timely decisions by the authorities.
2. Non availability of stores, proprietary items etc.
3. Delay in approval of design, drawings and specification for proceeding with the work.
4. Delay in payment to the contractors for the work done
5. Change in scope and volume of work due to incorrect preliminary investigations necessitating change in date during the course of actual construction or unanticipated problem such as floods, cyclones etc.
6. In complete and indefinite specifications.
7. Labour problems.
8. Land acquisition is not completed before hand
9. Frequent deviation orders.
10. Non-indication of physical phasing for work completion
11. Delay in sanction of revised estimates
12. Improper vendor/contractor selection
13. The site is not handed over to the contractor in time
14. Non receipt or late receipt of government clearance.

## **5.6 COST OVERRUNS**

With respect to cost, the second dimension it is rather difficult to complete a large work, which is likely to require more than one year for completion, within the estimated cost since the construction prices rise even faster than the rise in the

consumer price index. Therefore the concept of successful completion of project within the estimated cost has to be changed to successful completion of project with the expected cost of completion on the date of completion by adding likely escalation in cost. Whether a project has been completed within the expected cost or not, can be rationally assessed by considering the estimated quantities and by evaluating the escalated rates for various items during the completion period.

The contract price can be known only when the contracts have been awarded through the process of seeking quotations through tenders. Contract costs are often exceeded because of

- (a) an increase in quantities
- (b) the introduction of new items of work
- (c) the claims of contractors based on delays
- (d) break and rebuild due to change in drawings
- (e) financial constraints leading to delayed payments, interest payments and idle time claims by contractors.
- (f) An increased cost of project management
- (g) An escalation in costs.

Generally we come across atleast some of the above bottlenecks in a project causing time and cost overrun.

## **5.7 SOME REMEDIAL MEASURES FOR SPEEDY IMPLEMENTATION OF PROJECTS**

Some remedial measures are suggested for controlling time and cost overruns.

1. Project execution should start only after collecting sufficient engineering data during the planning stages of the project.
2. A programme is prepared, indicating the date by which drawings are ready, the date of receipt of preliminary information and the date of issue/receipt of tenders.

3. Physical phasing of the complete work and a realistic detailed time schedule should be prepared using PERT/CPM techniques to achieve time-cost optimization through network analysis of the project.
4. The Preliminary Information Performa (PIP) should envisage detailed information for period of completion of work, availability of water/ electricity details of stores, availability of land, draft schedule of items of work.
5. Ensure the detailed estimate is prepared properly and checked before inviting tenders.
6. Obtain financial concurrence before the tender is floated.
7. The site has to be handed over to the contractor early after work order is placed.
8. Discourage midstream changes in specification and scope of work after tender finalisation.
9. Ensure site visit/survey, soil investigation and collection of necessary information.
10. Experienced consultants may be approached incase in house expertise is not available.
11. Ensure realistic planning with proper delineation of basic items of work.
12. Provide more thrust on selection of contractors/sub-contractors. Lowest bid is not necessarily the only criterion to accept the tender. Only reliable contractor with good track record/performance rating should be awarded the job.
13. Provide stringent clauses of penalty in case of failure of contractors to execute a job in time.
14. Co-ordinate and monitor the order placement on vendors to ensure that they are not overbooked with reference to their capabilities.
15. Billing schedule with the contractors/suppliers be so designed that the payments should be incentive for the site progress.
16. Provide effective monitoring system
17. Provide adequate infrastructure facilities such as construction power, water, road, railway etc.
18. Develop partnership approach in which the client, the consultant and the contractor will work as a strong team.
19. Encourage mechanised method of construction

20. Organise, develop/train all concerned in construction management including design, planning, material management with emphasis on low cost and high quality construction.
21. Consultants should have site organisation to provide expeditions site/design decisions.
22. Provide effective co-ordination amongst various participants
23. Right information must be communicated to higher authorities, without fear so that corrective action, if any, can be decided.
24. Set performance standards and targets for each staff of the project team in key result areas.
25. Encourage use of computers for resource planning and systems, approach to project management.
26. The construction team be headed by an experienced, dynamic and result oriented Project Manager. The team must work with dedication, sincerity, commitment and strive for professional excellence. The manager must create an atmosphere in which they can motivate themselves.

The consultant must furnish the dates and the various stages of the project at which the drawings would be issued. These details must be furnished in the tender or at the commencement of the contract.

If the finalisation of working drawings depend upon certain site information, details of such information must be given to the contractor in advance, so that the contractor can arrange to provide the information at the earliest. Even if providing all this information delays the commencement of the project, it is nevertheless advisable as it will eventually result in earlier completion within budgeted costs.

The time required to complete the project is usually stipulated in the tender documents and the contractors have to price the tenders on this basis. This time schedule is often not realistic. Along with the tender the contractor should not only submit a detailed program but also the technology to be adopted, resources provided during the various stages, the organisation he will maintain and other such factors. This write up should be detailed enough to convince the consultant and client of its

feasibility. The selection of the contractors should be based on his price, time schedule, resources and past experience.

A project must be designed in entirety, working drawings made, the bill of quantities prepared and only then must tenders be floated.

## **5.8 PROJECT MANAGEMENT**

The terms Construction Management and Project Management are used synonymously. Project Management is a separate discipline and treats Construction Management as a component within PM. Construction Management is the composite of all modern management methodologies having as their objectives the control of time, cost and quality in the design and construction of a new facility. Project Management is the term by which this process is more frequently referred to abroad, in order to emphasize that the conceptual planning, pre-design and design phases may be of equal or greater importance to the control process as compared with the field, or construction phase. Project Management starts with conception of the project and ends with overall control of the total process to optimize three major attributes of the process-quality, schedule and costs. Significant optimization of these three attributes can probably be achieved by proper management right from the conception stage to the completion of construction.

Project Management is increasingly becoming an exciting field. The very fact that a large chunk of India's 9<sup>th</sup> Plan outlay (as high as 50% of the plan outlay) is going to be spent on civil construction of one type or other implies the importance of Project Management and Project Leader. It is all the more so because our track record in Project Management has been rather poor. Project Management has two distinct wings viz. project implementation and contract management.

## **5.9 EFFECTIVENESS IN PROJECT IMPLEMENTATION**

The success of a project mainly depends on the effectiveness in Implementation Phase for it represents the lion's share of the project effort. This phase encompasses

various stages from engineering design to commissioning. Included are negotiations and contracting, construction and training of personnel. The Project Leader responsible for it is the pivotal person in the context of Project Management. Project implementation is precisely the activities of the clients (owner) and the consultant (Architect).

#### Clients Responsibilities and Rights:-

The feasibility study of the project should include formation of objectives selection of location, delineation of overall approach to achieve defined objectives, financial implications, relevant constraints, procedure for execution and forming of the organization. In short the owner must have a clear concept of his objectives and how he is going to achieve them.

The Owner's responsibilities include carrying out detailed investigations, acquisition of accessible land, providing infrastructural facilities, selection of quarries, arranging finance, obtaining permission from the concerned authorities and appointing the consultant. The owner should be ready to bear the financial risk arising from changes in design made for his benefit and/or changed conditions. The owner has to compensate the contractor for these changes, extreme contingent conditions, addition in work, unreasonable interpretation of contract conditions and specifications, and statutory increases.

The owner should co-operate with the consultant and the contractor, and at the same time expect quality service and co-operation from them for efficient and timely completion of the work at the lowest possible cost.

#### Owners Functions:

Preliminary Planning:- This generally includes

- (a) Design, detailed plans and specifications;
- (b) Programme with appropriate milestones;
- (c) Budgeting provisions;
- (d) Resource requirement for each task; and

(e) Building up of the organisation for project execution.

The owner has to oversee the selection of the project team, strength of personnel, technical problems and expertise needed, concerned reconnaissance and surveys etc., as required for the particular project.

**Detailed Investigation:** The owner should arrange to carryout detailed investigations for geological, hydrological, climatic and site conditions, suitable quarries and all other conditions relevant to the work and take responsibility of them.

**Infrastructural Facilities:** The owner has to acquire the work-site and provide access to it well in advance. It is advisable for him to provide the necessary facilities such as roads, electricity and water supply and some accommodation for the contractor before awarding the contract to save time.

**Permission from Local Authorities:** The owner should obtain all necessary permissions from local authorities such as the municipal corporation, fire fighting department, explosives inspector etc. as required for the particular work.

**Finance:** Reliable arrangements for finance must be made as the work proceeds to avoid stoppage of work.

**Architect's Responsibilities & Rights:** The Architect's responsibilities include designing, planning, preparation of tender documents, framing estimates, invitation and acceptance of tenders, timely supply of construction drawings and decisions, supervision of construction, co-ordination between various agencies, monitoring of progress, checking of bills, certifying payments, fixing of rates for extra items, management of claims and settlement of disputes.

The Architect works on behalf of the owner and expect full co-operation and support from the latter. He has the right to expect that the owner accept any liabilities that may arise from changed conditions in the absence of any proven negligence by the contractor.

## **Architects' Functions:**

**Designing, Planning & Drawings:-** It is essential for the designer to understand the client's objectives precisely. In interpreting these instructions, the designer should tailor his attitude and approaches to suit the client's needs, and prepare a design suitable for actual construction. It is essential to take into account the availability of resources, labour skills, equipment etc. He should also ensure that the structure is resistant to weathering, fire, chemical attack, ageing and fatigue. It is advisable for the Architect to prepare detailed construction drawings before the bids are invited. This will enable contractors to prepare more accurate bids and consequently minimise disputes. The Architect should also formulate a detailed construction programme showing the sequence of work to be completed with intermediate and final targets.

**Preparation of Tender Documents:-** A great deal of attention needs to be given to the compilation of the tender document as it ultimately becomes the contract on award of the work.

It is usually observed that the owner and the architect want to pass on most of the risk to the contractor. The result is one-sided contract conditions, favouring the owner. The contractor is none too eager to bear the burden himself. Although all the participants have their own responsibilities, the owner has the greatest responsibility in terms of management risks, and minimising associated costs. This is in his own interest as he is the principal party and permanent beneficiary of the project. Some suggestions for the sharing of risks are given below. Risks the Owner should bear relate to acquisition of and access to work site, changed conditions, large variations in quantities, defective design, delay in supply of drawings, delay in payment, damages due to force majeure and escalation in the requisite materials, machinery and labour. Risks the contractor should bear include the inherent risk in bidding, his capacity and experience, availability of men, materials, equipment, finance and safety measures. The conditions of the contract should be fair and equitable and should be stated in clear, concise and unambiguous terms to avoid disputes. Contract conditions must be appropriately worded, being in full conformity with the law of contract and its provisions to minimise disputes and claims. Careful consideration should be given while providing exculpatory clauses as they create disputes in most of the cases. The



specifications should be carefully drafted and standards prescribed should be not only adequate to meet the work requirements but also realistic achievable and enforceable. The schedule of quantities and time of completion should also be realistic.

**Framing Estimates:** - An accurate and realistic estimation of the project is vital for its successful implementation. Proper construction methods have to be envisaged for a proper analysis of the costs involved. The quantities should be worked out accurately and items should be priced on prevailing market rates. Apart from the direct costs of materials, machinery and labour, indirect costs of over heads, establishment charges and anticipated escalations over the contract period should be added.

The contractors are guided by the architect's estimation of costs. Accurate and realistic estimates will generate healthy competition while bidding.

**Invitation and Acceptance of Tender:-** The tender document must formulate its propositions explicitly and present all relevant information in a methodical manner. Tenders for large and complete work should be given to the pre-qualifying contractor. Pre-bid conferences with contractors should be held for assessing their view points on certain important issues. The owner must give adequate time to contractors for submission of their bids. The architect and the owner need to be very careful in acceptance of the bid, as the contract cannot easily be rescinded after it is signed. When there is intense competition they should not be tempted to create unhealthy completion by re-inviting tenders with a view to getting further reduction in the bid price. This may lead to an unworkable bid. If the lowest bid appears unworkable, they should not hesitate to discard it and award the contract to the next bidder.

During the bid evaluation process, additional information should not be received or requested for unless absolutely necessary, since bidders may try to improve their offers. Disregarding to this policy may easily result in conflicts and claims by each of the bidders, making award of the contract more difficult. The architect and the owner should guard against bids containing several clarification and explanations.

**Supply of construction Drawings and Decisions:** - It is customary in our country to supply detailed construction drawings not with the tender but only as the work

proceeds. This often leads to postponement of decisions upto the last moment and creates delays leading to disputes. As a result, the contractor is able to cover his faults and succeeds in getting extensions in time schedules and at times even compensation. The time clause which is the essence of any contract, then becomes infructuous. If the architect were to supply detailed construction drawings along with the tender, he would be able to insist on the time schedule. The ideal method would be to invite tenders after all major decisions are taken and detailed drawings prepared. This will not only help in the preparation of correct schedules of quantities and estimates, but also enable the tenderers to price their bids more accurately.

### **Supervision of Construction:**

This includes programming, co-ordinating and monitoring of progress and quality control. The architect should insist that the contractor submit a detailed construction programme with milestones and the completion target as soon as the work is started. The architect has to provide proper co-ordination among various agencies, monitor the actual progress of the programme and ask the contractor to take remedial measures if required for achieving targets. To facilitate adherence to the programme, holding of weekly, fortnightly or monthly co-ordination meetings depending on the size and type of work are recommended. The architect should ensure that the decision taken at such meetings are enforced without delay. The architect must insist on optimum quality of work from the very beginning, to prevent any laxity on the part of the contractor. He should also ensure a congenial atmosphere and good relationship among the various agencies involved.

**Certifying Payments:** The architect has to check and certify the bills of the contractor for payment, besides insisting that the owner make prompt payments within the time frame provided in the contract.

**Fixing of rates for extra Items :-** It is observed that prompt attention is rarely paid in fixing rates for extra items, which prevents the contractor from getting a large portion of his dues. The architect must therefore see that such rates are properly fixed to prevent inconvenience to the contractor.

**Management of Claims** :- The architect should remain ever vigilant and tackle any dispute raised by the contractor in the initial stage itself. If disputes remain unsolved for long, the vital details pertaining to the disputes often get obliterated, and the claim becomes intractable.

The contractor invariably advances his claims for cumulative and general losses in case of disruption to affect the morale and productivity of workers and result in a reduction in their output besides increasing overheads. The contrast in experience between works that run smoothly and works which are impeded for any reason, proves that such claims may be justified. At the same time, it is quite clear that disruption claims are often based on imagination and assumptions rather than on facts. It is not difficult for a contractor who has incurred a loss to exaggerate minor delays inevitable in large - scale work and to distort the real sequence of events by alleging delays on the part of the architect when, in fact, he was not in any case, ready to do the work involved. The result is a wildly exaggerated disruption claim made in the vaguest possible way, and at times the contractor succeeds.

To prevent this, the architect should firstly avoid disruption in the work due to his conduct and actions. He must also monitor progress regularly and prepare proper records (such as correspondence, charts and photographs) of various events as the work proceeds. All discussions with the contractor should be properly minuted. This will help him in the settlement of claims, if the need arises.

**Overall Management:** - The architect has to function as the leader, ensure proper interaction and create a harmonious relationship among various participants, and resolve controversies, problems and disputes as they arise. This will go a long way in ensuring the successful completion of the project.

## **5.10 TRAITS OF SUCCESSFUL PROJECT LEADER FOR BETTER EFFECTIVENESS**

It is universally accepted that effective implementation of projects is mainly dependent on the Project Leaders. Some Project Leaders are able to achieve much better progress than several others. They sail their way to the top, setting the standards

everyone else has to follow. What sets star performers apart is that they know how to use what they have.

In India, where crores of rupees are spent every year in projects, traits of successful Project Leader and his teams will be of much useful to educate others regarding the successful methodologies tested by Project Leaders who achieved results. Certain leaders, on many occasions, are preferred to take up the tasks of accomplishing time bound projects. They are said to be comparatively more effective in making things happen. Such a comparison is universal in any field of activity. This is because some persons do have certain inherent qualities to make others work to their best while others apparently do not have. Now it is possible to scientifically measure and assess the required qualities for performance in an individual.

This is of great importance because of the fact that those who do not have such inborn qualities can be developed by training to learn and use the necessary skills in practice. Such training can make even the persons lacking the inherent qualities extract work either equally or more effectively than the engineers. In general, most of the engineers believe that once a plan is made for any development programme, the activities that follow are a natural consequence. He is blinded by the technical excellence of the plan. He often forgets that for materializing things "something" other than engineering expertise is required. That "something" is the human effort. This effort is needed at every level, right from the graded worker to the meanest worker. Thus put into actual practice, is the effort that determines the effectiveness and efficiency of any result oriented programme.

Project leaders generally assume that human efforts automatically follow. When the human efforts are not forthcoming to the desired level, the quality of human material is blamed without exploring why the people are not giving out their best. They also list out many excuses for the pit - falls in performance. When questioned further they generally react saying that their function is something else and they have nothing to do with making the people work. They forget that the narrow concept of blaming personnel and finding excuses for pit falls in performance is not the good trait of the project leader. He has a responsibility of watching his plans on paper transferred

to the field and make others see or feel the effect of his planned ideas. For this, he should acquire the basic knowledge which make people carryout the assignments with effectiveness and efficiency. The human aspects that come into play in achieving performance may be termed as "human dimensions in performance effectiveness". In today's context of increased competitiveness what we really need is the able, efficient, committed and dedicated Project Leader, for any successful implementation of a project. A critical study of major construction projects in Kerala, throws some light on some of the human aspects related to performance effectiveness. In the case of long delayed (it took 12 years to complete) Kerala Legislature Complex Project, during the crash phase of last two years, the work team became cohesive with high team spirit and all the members felt a sense of urgency in the implementation as the new Project Leader, convinced them that achievement of target was within reach. They appreciated the performance - orientation, quick problem solving style, willingness to listen to subordinates without abdicating responsibility, clarity on objectives, awareness of all details, quick decision - making after discussion and without ignoring subordinates and the goal directed approach of the new project leader.

Similarly, it was due to the dedication of the Project Leader that GCDA could implement 73 crore project of International Stadium at Cochin within a record time of 515 days. The Project Leader created a climate of participation, maintained hierarchy and facilitated communication by the introduction of the new system of everyday morning review meetings for an hour with technical field officers, contractors and other concerned person at the project site office. The team members also felt that the Project Leader enjoyed complete support from the higher ups including Chief Minister and his goal - directed approach enabled him to get all the facilities, resources for completing the tasks within the stipulated period. In addition, the Project Leader was perceived as one with high integrity and high commitment to the project. He was also seen as one who could persuade local leaders and other departmental officers including the City Police Commissioner to attend meetings and solve local problems that hindered the progress of work.

In short, the personal style of the Project Leader, was perceived as instrumental in both cases for achievement of the target on time. The personal style was perceived

as one that created enthusiasm rather than fear at immediate subordinate level. Lower level subordinates felt both enthusiasm and fear and at the lowest level there was a strong feeling of fear. Team members felt that the leader would take strong action against indiscipline and the action of the leader would be supported by officials at higher levels. The members further perceived that the Leader acted as a facilitator, a trainer of the subordinates and a representative of the group to the higher ups. Team members felt that the contractors' feeling of power and influence at higher levels dwindled, and the contractors feared that they might be put into disadvantages if they did not obey the decisions of the engineers and had to withdraw their resistance to high speed of work. The enthusiasm and feeling of confidence of the members were revealed by their expression of willingness to continue with the team under the project leader with the psychological atmosphere created for the completion of the project.

Perceptions of the project by the contractors as revealed by the personal interviews: -

Personal interview with the contractors revealed that they became aware of the time-bound nature of the project and the need to complete the works within the programmed target date. They also experienced certain differences in the projects in comparison with other works they had undertaken. Availability of all required facilities, physical presence of the officers at the work spot, prompt payments, supply of specialised materials on the spot, prompt decisions, settlement of labour disputes by involvement of higher officials, technical support for problem - solving by officers for reducing the work time, technical support of officers by developing new methodology for problem solving, officers' enthusiasm to complete the work on time, were perceived as the positive nature of the project. The project leader was perceived as competent and committed to work with a high degree of integrity. Hence they did not feel that need for approaching higher ups - ministers and political leaders to settle disputes or to get favours, though they confessed that they were capable of involving and indulging in such practices. The daily meetings provided a venue for interaction and this created better understanding among themselves. The gradual development of a favourable climate was evident even though there was resistance for daily meetings in the early stages, it became well accepted later.

## **Role of Project Leader:-**

From the limited discussions so far made, it is clear that the project leader has to play an important role in almost all the functions of construction management for productive performance. Construction management is an unseen co-ordinating factor which brings together the resources of the construction industry namely men, machines, materials and money.

The main functions of construction management are (1) Planning (2) Controlling (3) Directing (4) Organising (5) Staffing (Personnel) (6) Co-ordinating.

**Planning:-** Conceptually, planning is, looking ahead. It is deciding in advance what to do, how to do it, when to do it and who is to do it. The important human dimension in this area that the group leader is concerned with is his ability to make the members of the group understand the various sub-group objectives and the overall objectives so that they may integrate the sub objectives to achieve the overall objective with a spirit of goal achievement.

**Monitoring:-** Any amount of planning cannot be successful without controlling. The critical study, reveals that the daily review meetings was one of the important factors that contributed towards the achievement of the overall objective in time. In the process, the leader was able to apply certain aspects of human dimension for better advantage. An effective leader can be of great assistance to the members through his control function and he can develop good human relationship resulting in a better morale. This will contribute to develop a healthy work climate.

**Directing:-** the leader has to tune his efforts to make effective use of human resources available with him. This function of making people work effectively towards objectives within the organisational and environmental constraints is "Direction". An element of force is implied in the directing process. The leader also is a human being; and he has to work as an individual and also as a member and leader of group. His personality also influences the organisational climate and in turn, the effectiveness of total performance. The perception, values, styles and skills of a leader determine his art

of directing his subordinates and the art of playing the role of a subordinate with respect to his superior.

**Organising:-** For effective performance, the questions of who decides what, who tells whom, who responds and who performs what work, etc have to be answered. This necessity resulted in having an organisation structure. The structure should be appropriate to develop favourable work climate conducive for effectiveness and efficiency in performance.

The individuals in group may have different approaches to achieve the goals; the different groups also may have different approaches. All these approaches do not automatically mesh. The leader has to reconcile differences in approaches and harmonise individual and group efforts to achieve organisational goals. This is done by co-ordination. The aim of organising is to specify the duties, responsibilities and jurisdiction of each individual working in an enterprise.

**Staffing (Personnel):** - It is the process of appointing the requisite number of personnels to man the project. It lays down the process by which the people are selected, trained, promoted or retired. This is done keeping in mind the magnitude of the work and the funds that are made available.

**Co-ordinating:-** It is the process by which the frame work structure of an organisation works smoothly. This is done by making the flow of information, decisions and results in every direction. In other words, it means a right job at right place and time. Although some measure of co-ordination is essential for all construction yet its importance cannot be over stressed in the case of industrial construction. There, all sequences are to be carefully and meticulously arranged. Without perfect co-ordination between the engineers of the various branches the timely completion of such project is not possible.

**Motivation:** - Motivation is a dynamic aspect of human behaviour. It is the process of directing a person towards a goal and make him accomplish work enthusiastically without external compulsion. Inducing motivation to perform well depends on the



managerial style of the leader. In the study, the managerial style of the leader in planning, problem - solving and decision - making through discussion in the daily meetings created feelings of involvement and commitment which helped in developing a motivating climate. Development of a cohesive team for group motivation helped to overcome deficiencies by providing necessary interpersonal support. If a leader wants to influence his subordinates' behaviour he must first understand what needs are most important to that person at that time and try to satisfy the need through accomplishment of goals. Giving people the opportunity to grow and mature on the job motivates them and allows them to use more of their potential in accomplishing goals.

**Leadership:-** Normally, the percentage utilisation of the capacity of subordinates by a manager is only say upto 40%. But few managers are able to increase the capacity utilisation of their subordinates much more than the normal level, say upto 90%. This quality of the manager to get more utilisation of capacity of the subordinates is known as 'leadership'.

A leader puts into action and leadership influences all functions and activities that concern performance. Leader - behaviour affects the motivation of the work group. Leadership is a dynamic function. Leadership in effect, determines the success or failure of any implementation programme.

**Communication:-** Communication is the process of transformer of information between two or more persons. Also it is the means by which people in an organisation are linked together in order to achieve its goals. The leader who is unable to get his subordinates understand what he wants them to do, will not succeed in making them to do it. If they are unable to communicate with him, he will not receive the information necessary to collect them when required.

Communication is effective only when the recipient receives the message and understands it in the same way that the sender intended him to understand. The clarity of the message is an important aspect in the effective communication. Listening is an important link in the process of oral communication. In efficient listening is a major problem in any organisation for effective performance. There is a tendency on the part

of the superior not to listen to the emotional content of what the subordinate has to say. This results in the failure of the superior to understand the feelings of subordinates. By patient listening a better superior - subordinate relationship could be developed creating a motivating climate for better performance.

It is the human effort that determines the effectiveness and efficiency of any result oriented programme. In a governmental set-up, where rules predominate performance and employees are generally not sufficiently motivated, effectiveness with the available people in the organisation is possible even without the application of scientific quantitative methods, provided the right type of work climate is created by the Project Leader by his style, attitude and decision making skills. The project leader has to play an important role in almost all the functions of management for productive performance. The leader has to give lot of consideration to the human dimensions in planning, controlling, the directing, organising, staffing and co-ordinating the various activities performed by individuals in the work situation. The leader should see that he is accepted as a leader of the work group not because of his formal position but by his leadership style. He should be a trainer, a friend and a protector of the team members. The leader should ensure proper interaction through effective communication and co-ordinate the activities for the achievement of the common objective. He should build his team as a well - knit unit, eliminate or control conflicts, induce motivation and boost the morale by his leadership style to develop a favourable work climate. Such an environment, no doubt, will produce effectiveness with efficiency in performance as revealed in the case of Konkan Railway Project, Cochin International Stadium Project etc.

### **5.11 NEW TRENDS IN PROJECT MANAGEMENT**

The 'fast-track' concept of project execution will demand deeper foresight and higher skills in overall co-ordination of a project. It is being widely used in USA and here design and construction are closely integrated activities, thus making it possible to commence construction activities while the design is still being conducted. Though such a concept would help in saving of time on execution, it will also demand deeper

foresight and higher skills in the overall co-ordination of the projects because of increasing complexities creeping in due to vast technological advancements.

## **5.12 CONTRACT MANAGEMENT**

In contract management, it is obvious that contractors play the major role, once the job is entrusted to them. The contractor generally assumes the responsibility for delivery of the completed facility at a specified time and cost. In doing so, he accepts legal, financial and managerial obligations. Therefore, construction management is important for the contractors and they must start with right earnest and with proper planning. They must realise that once the site is opened their expenses will start and they must finish one day in advance, if possible.

In a contract, there is only two main parties dependent integrally with each other for smooth movement. The role of an architect is also equally important for a well-directed and smooth movement. During execution of contract, several other parties are involved with the contractors, as for conceptual stage many parties are involved with owners/clients.

For works of large magnitude, granting mobilization advances and advance on equipment required for the work and brought to site has been accepted. The interest to be charged on such advances may be concessional. Often works get delayed due to delays on the part of government, whereas the government has remedies against the contractor for delays. The contractor do not have any such remedy except going for arbitration or to the courts. In 1987, Model Tender Documents remedy had been provided by making government responsible to pay the contractor the actual costs of his idle labour, staff, if any, appropriate overhead charges, interest on the capital lying idle by way of equipment.

At times, payments to contractors get delayed for no fault of theirs. By way of redress provision for payment of interest on such amounts is made in the model documents. The accountability aspect of government procedures is expected to result in avoidance of interest consequently avoiding delays in payments.

The rate quoted by the contractor can be taken to be applicable only to a reasonable excess over the scheduled quantity. This is now accepted as applicable to  $\pm$  30% and the quantity executed beyond this limit is treated as extra item.

The rate for any additional work or for extra item shall be mutually agreed to between the engineer and the contractor. In the event of such an agreement not having been reached in a reasonable period, the rate may be decided by the engineer as may, in his opinion, be reasonable and proper and payment made for such additional work.

CPM-PERT Charts :- Time is the essence of the contract. This expression often finds a place in the contract documents. Towards this end, it is customary to ask for CPM-PERT charts for control of the progress of work. Often, and for many reasons which are not attributed to the contractor and this is so stated, extensions of varying periods are granted. Further, the work rarely proceeds according to the given PERT chart and construction programme is required to be revised. Therefore, while the PERT charts and periodic revision thereof jointly should continue to be specific term of contract, too much reliance on these for taking action against the contractor might present problems and, therefore, should be resorted to with due care. It may have to be kept in mind that a threat of punishment rather than actual punishment, may be a better tool to be used. The provision for liquidated damages has, therefore, to be used with considerable circumspection.

**Management Information System:-** A better way would be to continually review the programme and the progress of work with regular periodicity so that there is greater involvement in the work of the person from both the sides. To achieve this, a properly throughout Management Information System indicating the programme and progress of work, the requirement and use of various materials, available equipment, its status of repairs and actual availability and use, labour strength, their output in relation to the programme of work, various targets etc. will be required. This aspect is not being given adequate attention it deserves on many projects. Even more collection of information in this regard may prove to be advantageous in deciding some of the disputes by demonstrating the facts as they occurred at site at that point of time. This

will also assist in anticipating the bottle necks well ahead their occurrence and initiating timely remedial actions.

**Arbitration:** - Due to persistent pleas from the contracting industry, and with a view to make the documents fair and equitable, all large contracts have a clause on arbitration. The purpose is to ensure speedy decision about disputes or differences which are likely to arise between the contractor and the employer, thus avoiding litigation involving long drawn out court procedures. There is also a fair degree of finality after an award is made by an arbitrator under the provisions of the Arbitration Act unlike a verdict from the court on which an appeal may be made right up to the Supreme Court.

It is certainly possible to minimise disputes by carefully drafting contract documents and drawings and a meeting of the minds regarding the rights and obligations of both parties. It should also be an accepted fact that the contractor is entitled to his reasonable profit.

Since the lack of knowledge of the provisions of the Indian Contract Act created many a dispute, it would be advisable to introduce among the subjects taught in Engineering colleges and Polytechnics, the Law of contracts also. This would help the engineers realise that both the employer and the contractor have equal legal status and that there should be mutual respect to ensure smooth working.

There are several mistaken ideas about the correct legal interpretation of the time of completion, penalty and termination of a contract. Both the contractors and the engineers should know their own rights and responsibilities, as interpreted by the High Courts of the country. The arbitration agreement forms the basis of any arbitration. The function of the arbitrator, the mode of selection of the arbitrator, the rules of procedure etc. should all be covered by this agreement. Hence it should be drafted with great care. Many of the provisions in the arbitration agreements adopted by Governments may not stand a trial by law because of their one sided approach. In the state PWD, the arbitration clause has been deleted.

### 5.13 CONSTRUCTION MANAGEMENT

It is necessary to discuss relevant factors that play an important role in making a construction project a success. Skillful project management involves knowing what is to be done, who will do it and how and when it should be done. Everyone manages projects but some people manage better than other. Construction Management is thus nothing but a way of getting things done. The contractor is responsible for his bid price and for a well - planned, well equipped and well managed job of the required standard. He should make timely arrangements for labour, materials, machinery and finance required as per the construction programme. He should provide well-qualified and experienced personnel to supervise actual construction and co-operate with the owner and the architect.

In turn the contractor assumes that the contract price he bid for completion of the project, is in accordance with plans and specifications under the conditions described or implied in the tender document. The contractor also expects payment for charges in design, and/or conditions, additional works, unreasonable interpretation of conditions and specifications beyond his control that are substantially more severe than would be covered by the reasonable contingency provided by him in his bid price.

Contractor's functions include bidding, proper and timely execution of works of good quality and their maintenance, the management of his claims and the safety and welfare of the workers:

**Bidding:** - The contractor is responsible for his bid price. He should therefore, prepare his bid after thoroughly studying tender documents, site and market conditions. He should assess possible risks and likely escalations and make suitable provisions for them in his bid price. Every contractor has his own method of working out the price. The method he adopts matters little but he must ensure that every cost is taken into account. The contractor must always avoid unhealthy competition by quoting below his cost in the hope that some how he will be able to make up later.

While bidding for a new type of work the contractor has to be extra cautious. Similarly, while bidding in a foreign country, he should take all precautions and consider local prices of materials, labour and their availability, local laws and customs and other conditions. Bidding is by and large, a skilful balancing act. The contracts should not only cover all his costs, but also attempt to win the contract by fair means and make profit. This requires experience and sound judgement.

**Preparatory Work** :- For carrying out construction activities efficiently, a proper job layout to suit the type of work under execution and the topography is required. Site offices, stores, works hops, other services facilities, fabrication yard etc. have to be selected such that the movement and flow of various components require minimum handling and transport. Proper accommodation for personnel and workers has to be provided as near to the work - site as possible. Similarly, locations of quarries, crushing and screening plant, concrete batching and mixing plant, etc., have to be properly planned to ensure adequate supply and easy flow of finished products. While fixing various locations, due allowances for future expansion have to be made. Adequate arrangements for supply of water, electric power and access roads to different work -sites have to be made, before starting actual execution of work.

**Planning and programming**:- Before preparing the construction programme, the contractor must study the work as a whole and divide the same into various stages and/or operations in accordance with the magnitude and time available for completion. The amount of work to be performed should be estimated for different operations. While preparing the programme, due consideration must be given to weather and other conditions. In estimating the rate of progress for any activity, due regard should be given to economy in construction.

The workers and units of equipment should be selected so as to effect the most economical construction, consistent with the particular operation and the entire work. After the programme is prepared, it should be studied carefully, again, to determine whether changes are possible and desirable to cut down time and cost.

Having studied all the details available, the contractor knows in advance items of works, their quantum, time required and the sequence in which they have to be completed. This can be shown in a bar chart programme. When the work involves many activities it should be supplemented with CPM and /or PERT programming techniques.

**Procurement of Machinery, Materials and Men:-** From the construction programme, an assessment of machinery and quantities required is to be made and should be shown on the programme against each item of work. Since different types of machinery are available for taking the same work, great care has to be taken in selecting them taking into consideration their suitability, cost and availability of existing machinery and spare parts. Requirement of various materials and the stage at which they are required have to be assessed in advance from the schedule of quantities and construction programme for their timely procurement. From the construction programme, the number of workers required during construction for different operations can also be determined well in advance. The contractor must ensure that his resources are adequate and progress of work does not suffer at any stage.

**Requirement of Finance and its Control:-** All construction contracts specify that the owner shall pay the contractor a part payment for the value of the work done during each month. A cash flow chart prepared from analysis of the construction programme indicates probable total expenditure and receipts. Thus the excess of expenditure over receipts shows the account of financing which the contractor must provide from sources other than the owner.

In order to control the cost, the contractor has to devise a suitable method for costing his work on either a monthly or quarterly basis and compare with the receipts to ascertain profit or loss. Costing will also help him while bidding for similar jobs in future.

**Co-ordination & Monitoring:** - The contractor's agent has to establish proper communication with the architect and the owner on the one hand and with his own supervisory and office personnel on the other. Easy communication and co-ordination



among different people working on the project are vital for its timely completion. After the construction programme has been prepared and the work started, real efficiency can be ensured by keeping a close watch on the actual progress achieved at regular intervals and by comparing it with the progress planned. This will enable the contractor to take corrective measures in time if and when the progress slackens.

**Management of Claim** :- Civil Engineering contracting is always a hazardous business. The contractor has to secure the contract against stiff competition and also earn a reasonable profit. Despite his best efforts and intention, situations may arise wherein he is helpless. This may be due to the inability of the owner or the architect to discharge their obligations as set out in the contract or other reason beyond his control making his expenditures mount due to no fault of his. In such an event the contractor should be able to raise and justify his claim. Even otherwise, on a large contract delays occur in spite of the best efforts of all the parties. Management of claims, therefore be considered by the contractor as an integral part of the operation of the contract. The client wants utmost utility at low cost. He overlooks his limitations and expects others to supplement and make good for these demands. Designers with technical expertise have to depend on inputs from clients and outputs from contractors. These inputs are often incomplete and not well defined. Designers have, therefore, to foresee and provide for several provisional issues and achieve a balance for effective construction and utility. The contractors have different priorities. They struggle to deliver the goods within the stipulated terms of reference, that is, technical bid and contract document their logical end till the payment is received. Persistent efforts in this manner are bound to benefit the contractor in every respect. He should also simultaneously ensure that no claims are raised against him and that no undue recoveries are made from his bills by the owner or the architect due to failure on his part as it is extremely difficult to obtain refunds of such recoveries.

**Human Management** :- Regardless of the type of business, the management reached its objective through the skilful use of people only. This is more so in the construction business. The greatest asset of any management, therefore, is its human asset. Employees have to be treated as honourable individuals, fully informed, properly assigned, encouraged and justly rewarded. Management must be able to provide the

right type of leadership so that all can work as a team. It also has to be deal with a large force of workers. Their welfare should be properly looked after so that no discontent creeps in, leading to possible strikes. In both these compilations, there are several uncertain parameters on which no one has control. The contractor often has to account for 'implied' provisions. This calls for calculated risk in bidding, thus leading to subsequent restraints on the project.

The broad requirements of a project are more or less well defined and specified. There are, however, several other related issues such as finance, management, insurance, welfare, safety and on going training in industry for its successful continuance. Added to these are uncertainties such as delayed decisions, and implementation of variations and fluctuations.

In one international contract, there was a provision for housing for construction workers to be paid for by the clients. The challenge involved prompted a top Indian firm to quote competitively so to get the job. Though their bid was second lowest, there was a difference of about Rs.5crore between them and the lowest international firm. Against the estimated cost of over Rs.6 crore for the housing project, the international firm had quoted Rs.1 crore lumpsum only. Against the estimated period of seven months for completion of the housing project, they had made provision of only one month with the above cost. Obviously, the job was assigned to this firm. They brought one large scraped ship having several bunkers for sailors. The entire crew of over 1000 workers was mobilized within a fortnight's time, ready to work and they straight away resumed the construction site. This saved six months of the project implementation and, most important of all, yielded a dividend to the firm in getting the job. During the entire project tenure, all the workers were housed on the ship and this offered several other advantages of subsidised messing and services. After the job was over, the ship was again sold in scrap, fetching a good return. Here in lies the skill of construction management. These decisions have not set precedence. Innovative and daring skill in resources mobilisation played the deciding role.

Present day construction management involves extensive vision, foresight and awareness of national and international markets. The opportunity and incentive for

right approach are unimaginable. The foresight of the top management man decides the fate of getting the bid and, in turn, opportunity for the organisation to grow and sustain itself. These are only a few examples of high level construction management. With the ever-increasing magnitude of projects and contractual commitments this particular skill of construction management has become exclusive and of vital importance. Co-ordinating the efforts and inputs of several parties involved in the game, and implementation of a set result-oriented plan, calls for a high level of management. Besides construction projects, there is good trade in various inputs like lime, cement, many types of building materials, equipment and even consultancy services. In all these areas, India is well equipped to enter the international market. Various experts foresee a rapid growth of international construction trade in the next few years but they say it will be highly competitive. The value of construction is likely to be of the order of trillions in the next few years; there are therefore new challenges and opportunity for Indian project exporters. Moreover, India is developing high quality construction capability by the formation of NICMAR (National Institute of Construction management and Research) NICMR was set up by industry, is backed by government and has a significant international presence.

A sound recipe for success in business today is to have the right commodity available at right place at the right time keeping pace with latest technology. Construction activity is an art which requires much knowledge for its execution, knowledge of its materials how they are made, shaped, erected and assembled, how they stood up to use and how they fail.

A trained Construction manager will have to be careful about communication of the solution for the executive action. For complicated construction activities, proper management techniques must necessarily be used. The project is thus to be executed in the most economical manner so that the structure, is consistent with the safety, durability and strength. Thus, management of projects reaches the desired results on schedule and within budget. For effective management, it is necessary to achieve given target and objectives with utmost efficiency, economy and in stipulated time.

## **5.14 COST CONTROL**

The ultimate objective of planning and supervising a project is to achieve maximum economy in the cost of construction of the project. The cost control can be exercised either during pre-construction or post-construction stages. In pre-construction stages, economy can be achieved in design and specifications. During post-construction stage cost control can be achieved adopting suitable quantity buying policy and exercising proper supervision, continuous valuation of output, avoiding idle hours, keeping overheads and taking safety measures etc. It is always useful to have three separate budgets for each element : (a) Direct labour budget (b) Support services budget and (c) Budget for purchased items. If the programme of construction during operation is well organized and effectively managed and implemented, the cost and the cost control system is adopted and followed, an immediate and as far as possible up-to-date utilization of resources can be compared with that specified at the target. The requirements for effective control system should include thorough planning of the work, accurate estimation of time, labour and costs budgets provision and authorization of expenditure, assessment of physical progress and cost expenditures, periodic updating of time and cost with schedule of work and frequent comparison of actual progress and expenditures to schedule and budget. The purpose of cost control is the comparison of time cost and performance to that of planned activities and also the decision-making. After verification of the expenditure, it should be compared with the budgets and to the work carried out. At this stage, the project manager should see that the discrepancies between the budget and actual expenditure is well within the limit. If not, suitable remedial measures need to be taken.

## **5.15 COST EFFECTIVENESS THROUGH CONSTRUCTION MANAGEMENT IN HOUSING CONSTRUCTION**

Housing shortage in India during 1990 was 29.2 million as per National Buildings Organisation. As per the 1991 Census the numerical shortage of housing in Kerala was 2.4 lakhs dwelling units. In the year 1992 there was a shortage of about 7500 dwelling units in the greater Cochin Region (Abdul Salam, 1992). Housing problem has been

assuming more and more serious proportions. This formidable situation calls for cost reduction in housing development.

There has been a need for low cost housing in India and many other parts of the world for decades. The cost of housing has increased in recent years posing great challenges to the engineers. There is an urgent need for reducing the time and cost construction by adopting improved production techniques, rationalising design methods for efficient use of even the traditional materials, by using innovative techniques and materials for housing construction.

Analysis of Building cost and material consumption:-

Attempts to achieve economy in building construction in a national perspective indicate the importance given to the aspect of cost reduction in its varied facets. This, however, is possible based on a critical analysis of the building cost and material consumption of the prevailing techniques. A study has been carried out based on the housing project completed by Greater Cochin Development Authority (GCDA) in the Cochin region. The average weightages based on a study for selected building materials and labour are given in Table 5.1.3

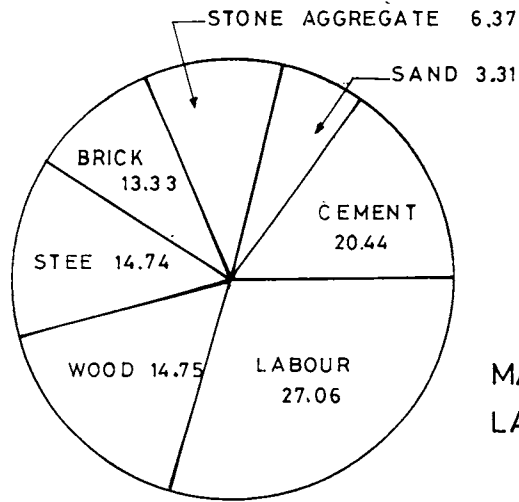
**Table 5.1.3 Average Weightage as per Analysis**

<b>Materials</b>	<b>Weightages, %</b>
Cement	20.44
Wood	14.75
Steel	14.74
Bricks	13.33
Stone Aggregates	6.37
Sand	3.31
Total for materials	<b>72.94</b>
Labour	27.06
Total (Gross)	<b>100.00</b>

The weightages arrived at have been compared with weightages adopted by CPWD and NBO and are shown in Fig. 5.15.1. This shows the importance of controlling the use of cement and timber by alternative materials or systems.

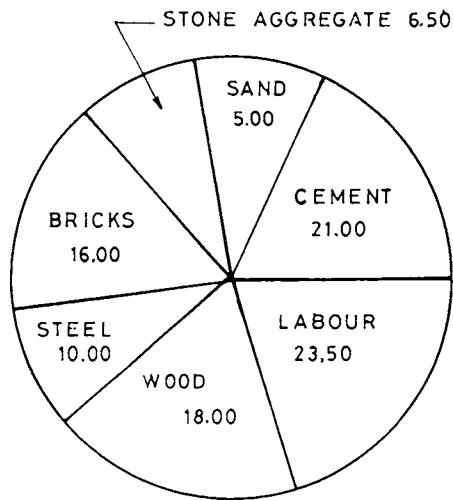
Possibility for reducing cost: The Goal of national housing policy should be low-cost construction for all, not merely for 'the poor'. The low-cost housing techniques should minimise the use of scarce materials, especially cement and steel and promote the use of materials available locally as well as materials which can be manufactured by small scale industry. The cost-reduction techniques are:

1. For all masonry construction lime-surkhi mortar may be used.
2. There is rarely functional need for plastering walls, but where walls have to be plastered, lime-surkhi mortar can be used.
3. Many windows in a house are seldom closed and these can be profitably replaced by brick jali walls.
4. Doors can often be frameless. Where frames are desired, the concrete frame is cheaper than the normal timber frame.
5. Wherever possible reinforced concrete filler slabs may be used.
6. Except for heavy duty floors, the use of the concrete base can be replaced by a brick bat base paving. The usual surfacing of cement plaster can be replaced with lime-surkhi or lime - cement combination plaster.
7. In the design of buildings, full use may be made for 114 mm walls and rat - trap bond.
8. Training and education are essential if cost reduction practices are to become a way of life.



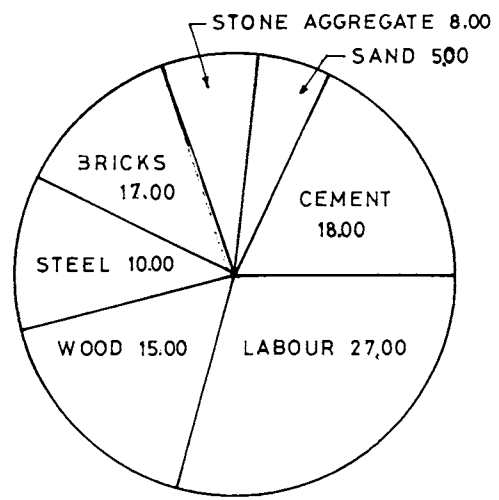
MATERIALS 72.94%  
 LABOUR 27.06%  
100.00%

AS PER CASE STUDY IN G.C.D.A.



C.P.W. D. VALUES

MATERIALS 76.50%  
 LABOUR 23.50%  
100.00%



N.B.O. VALUES

MATERIALS 73.00%  
 LABOUR 27.00%  
100.00%

Fig. 5.15 COMPARISON OF WEIGHTAGE FOR BUILDING COST INDEX

**Table 5.4 Construction Possibilities**

Main Building Cost Items	Percent of Total Building Cost	Percent range of saving possible on Each item	Percent Range of Overall saving on Total Cost
Foundation and basement	10	0-5	0-0.50
Superstructure (Walls and frames)	17	20-33	3.4-5.6
Doors and Windows	17	10-45	1.7-7.53
Plaster and Finishes	8	30-85	2.4-6.8
Flooring	5	10-40	0.5-2.0
Roofing	26	10-30	2.6-7.8
Plumbing, Sanitary and Electrification	17	0-10	0.17
	100	-	10.6-31.93

The need to reduce cost of construction, especially in the housing sector, can hardly be over emphasized Kerala has been a pioneer in the development of techniques for cost effective buildings thanks to Lourie Baker and his devoted team.

The areas where cost-effectiveness can be brought in have been identified. It can be seen from the data presented and Fig. 5.15.2 that the saving could be as high as 32%. But the attempts for the solution of problems such as development of cheaper, locally available materials and adoption of more effective construction techniques have not yet yielded the desired results.

While thinking of cost reduction in housing, the first name that comes to anybody's mind in India will be that of Mr. Lourie Baker. According to him, Low cost Housing tantamount to no-waste housing. The need of the hour is to put an earnest effort to see how the building code can be suitably amended to include the low cost technologies and materials rather than Baker Techniques replicating blindly, so that Public Works/Developments also can accept Mr. Laurie Baker's methods and techniques.



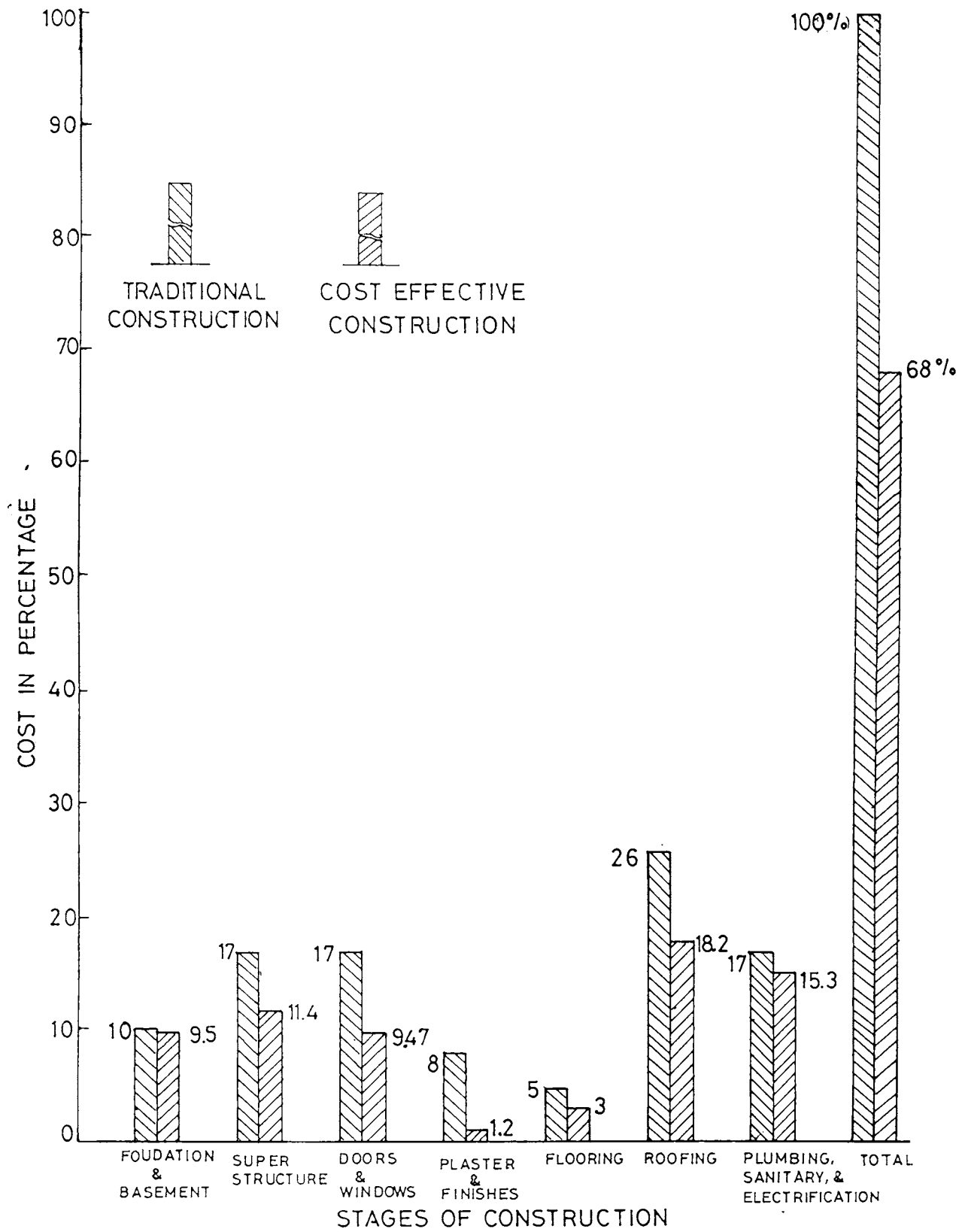


Fig. 5.12 CONSTRUCTION STAGewise DISTRIBUTION FOR TRADITIONAL AND LOW COST HOUSING

## **5.16 SCHEDULE CONTROL**

Schedule control assures that work is completed according to the planned schedule. The project manager has to be constantly vigilant to see that slippage is not accumulating at an unexpected amount. The slippage may be due to negligence on the part of organisation, lack of credibility, insufficient and missing information in competence or on any of the reasons beyond the control of organisation.

Schedule slippages are avoided as far as possible and prevented by assigning more responsibility, establishing check points reliable reporting system and supply of correct information. Project managers should not agree for the schedules which are impossible to meet. Scheduling is done in a systematic manner of a main construction activity, which could be well represented in the form of chart. Scheduling is done know the desired output of work with reference to material, men and machinery, useful deployment of equipments, cost control, priority purchase of construction materials.

## **5.17 MANAGEMENT TECHNIQUES IN INDIAN CONSTRUCTION INDUSTRY**

During the past decade a number of short courses and seminars have attempted to focus the attention of the professional engineers in construction industry on the various management techniques and usage of computers for the analysis and implementation of the projects. In order to find out whether this attention and awareness have been put to use in practice by the construction industry, K. Anantha Narayanan et - al reported that a questionnaire survey was undertaken at the Building technology Division, Civil Engineering Department IIT, Madras. The findings of this survey indicate that modern project scheduling techniques are gaining in popularity and practical usage with increasing interest shown by management personnel at various levels. It is also seen that the personnel are interested in switching over to computer aided approach to management. At present it appears that these methods are generally applied to the project scheduling at initial stage. But there is considerable scope for wider use of computerised methods in various tasks during project implementation such as updating, monitoring, decision making and project cost control.

## CHAPTER 6

### CONCLUSIONS

In this thesis, a critical study of major construction projects in Kerala was conducted in relation to effectiveness in project implementation. Based on the investigations carried out and on available reports in this area, the following conclusions have been drawn.

The basic ingredient of effectiveness in project implementation is a good combination of three factors viz-(1) workable estimate (2) competent contractor and (3) effective project management. The results aimed at are timely execution of projects, quality execution of work and cost effectiveness.

#### 6.1 EQUATION FOR THE CORRECTION OF AN ESTIMATE TO MAKE IT WORKABLE AND REALISTIC

The estimated cost of a project based on the official Schedule of Rates is always lower than the actual cost. It does not take into account the increase in price between the period the estimate is prepared and the project is started. The estimate does not consider the increase in price of certain key project constituents as a result of the Government budget which puts on additional burden on the project cost apart from normal inflation.

So, a correction to the estimate for prevailing market rates has to be adopted, to make it realistic.

$$C_1 = (E + 0.15 E) = 1.15 E \dots \dots \dots (3.5.1.1)$$

Where  $C_1$  - Corrected estimated cost in the second year

$E$  - Original Estimated Cost

0.15 is the escalation rate computed from the graph of Escalation percentage Vs year of construction.

(Vide Table 3.3 & Fig 3.4.1)

The equation can be generalised as

$$E_{\text{corrected}} = (1.15)^{n-1}E \dots\dots\dots (3.5.1.3)$$

Where  $E_{\text{corrected}}$  - Corrected Estimated cost in the year.

$n$  - Number of years elapsed between the estimate is prepared and Project is started.

$E$  - Original Estimated Cost

By adopting the above equation the reasonableness of the tender premium can be examined and evaluated.

Now the practice followed in state PWD is that the tender with more than 35% excess has to be sent to Government for approval. This means that from the third year of the preparation of schedule of rates, virtually every tender has to be forwarded to government. But, if the system can be changed in such a way that the tender with a rational excess percentage, adjudged by adoption of the equation, the work can be awarded to a contractor for execution by the Chief Engineer himself, without sending it to the Government. In doing so, the delay can be averted. For the implementation of this system in Kerala public works Department, the state Government has to issue necessary orders.

## 6.2 SELECTION OF COMPETENT CONTRACTOR

In P.W.D., like in other government departments and public sector undertakings, the contract is awarded to the lowest bidder, as a matter of course. The practice of accepting the lowest priced tender has got many drawbacks as explained in article 3.5.1. A paradigm shift has become a necessity. So, a new system is proposed for adoption in P.W.D. in the selection of a competent contractor based on the following criteria.

- 1) Registration of contractors as prevailing in PWD
- 2) Fixation of limits of his bid capacity
- 3) Selection through Performance Rating

The present registration system can be continued.

**FIXING CURRENT BID CAPACITY:** At present, in P.W.D., no limit has been fixed to a contractor for his capacity to execute any quantum of work in a given period. This means there are cases where a contractor with Rs 140 lakhs registration, bids for contracts, say ten works, with a total worth of 14 crores. There is no relationship with his financial capacity or technical competence. So there is a need to fix his bid capacity. The following equation can be adopted for the calculation of bid capacity.

$$C = AxNx2-B \dots\dots\dots(3.6.2.1)$$

Where C - Bid capacity of a contractor

A - maximum value of civil engineering work executed in any one year during preceding 5 years.

B - Value of existing commitments and works ( ongoing)

N - Number of years prescribed for completion of work

**SELECTION THROUGH PERFORMANCE RATING:** The performance of a contractor can be assessed and graded by a credit system. For that, grades can be assigned considering performance of the following parameters.

(i) Technical skill and infrastructure

The performance factor for Technical skill and infrastructure can be assessed by the relation,

$$P_1 = \frac{T_s + T_i}{2} \dots\dots\dots (3.6.3.1)$$

Where P<sub>1</sub> - Performance factor for technical skill and infrastructure

T<sub>s</sub> - grade point for Technical skill

T<sub>i</sub> - grade point for infrastructure

T<sub>s</sub> & T<sub>i</sub> can be obtainable by the relation

$$T_s \text{ or } T_i = 1 + \delta n_2 \sum_{x=3}^n \frac{1}{x-1} \dots\dots\dots (3.6.3.2)$$

$$\text{Where } \delta_{n_2} \text{ def } \begin{cases} 1 & \text{if } n \geq 2 \\ 0 & \text{otherwise} \end{cases}$$

(ii) Performance factor (P<sub>2</sub>) for Reliability of the contractor

$$P_2 = 1 \dots \dots \dots (3.6.3.3)$$

(iii) Performance factor for timely execution of projects

$$P_3 = 2 - \frac{Y}{X} \dots \dots \dots (3.6.3.4)$$

Where P<sub>3</sub> - performance factor for timely execution of the project

Y - Time taken for completion of a project

X - contract period

(iv) Performance factor (P<sub>4</sub>) for Quality execution of work

$$P_4 = 1 \dots \dots \dots (3.6.3.7)$$

(v) Performance factor (P<sub>5</sub>) for Cost effectiveness

$$P_5 = 1 \dots \dots \dots (3.6.3.8)$$

Maximum Credit that can be awarded to a contractor,

$$Mc = \frac{W_1 P_1 + W_2 P_2 + W_3 P_3 + W_4 P_4 + W_5 P_5}{n} \dots \dots \dots (3.6.3.9)$$

Where Mc -Maximum credit

W<sub>1</sub>, W<sub>2</sub>, W<sub>3</sub>, W<sub>4</sub>, W<sub>5</sub> – Percentage weightages allotted to each parameter

n - no. of parameters considered

A contractor shall be declared to have successfully completed the requirements for the award of the work/ project, if he has got relevant registration, bid capacity and acquires maximum credits.

How to eliminate a litigant and trouble shooting contractor :-

If the history sheet of a contractor or the document he produces reveals that he is frequent litigant and trouble some and the Engineer feels with his past experience that the contractor will not complete the project smoothly, it is better to eliminate him/not to award the work. For that, the Executive Engineer has to record the reasons for the elimination in writing. If the tender is on a two cover system and if the technical bid indicates that the contractor has gone for litigation many times causing trouble to the department hindering the smooth execution of the project, his cover of price-bid need not be opened.

**Legal problem:**

To adopt the above procedure for the selection of a contractor in PWD, this may meet with many legal and political problems, but they will have to be sorted out. For that, necessary legislation can be thought of by the Government. Also, action can be taken by the PWD to include the method of selection of a contractor in Kerala PWD Manual and Kerala PWD Account code.

**6.3 ROLE OF COEFFICIENT OF UNIFORMITY IN PROFIT DISTRIBUTION IN THE FINALISATION OF CONTRACTS**

If the tender of the successful tender is unbalanced or front-loaded, the distribution of profit will also be unbalanced. This happens mainly due to the strategy or tender jugglery resorted to by the tenderer when offers are given. The case study reveals that the contract of the International Stadium project at Cochin is front-loaded. The first four main items of work costing about 78% of the value of work was heavily overpriced by the contractors.

Coefficient of Uniformity in Profit Distribution (CUPD)

$$= \frac{\text{Front area with respect to Profit curve}}{\text{Rear area with respect to Profit Curve}}$$

CUDP plays a very important role in the comparative study of tenders and finalisation of contracts. It is an indicator in adjudging a front loaded tender. The front loaded tenders can be classified based on CUPD, obtained from Profit Curves. If the magnitude of CUPD is 1, the contract will be balanced. If it is between 1 and 2, the effect of front-loading will be tolerable. If it exceeds 2, it will be detrimental to the interests of the employer and negotiation can be resorted with the tenderer to get the rates reduced to get the uniform distribution.

**METHODS OF REDUCING THE RISK OF FRONT-LOADED TENDERS:-**The gravity of the front-loading has to be detected after opening of the tender by the employer. Three methods are suggested to circumvent the front loaded tender. They are

(1) Levelling of tender:

A levelling of the cost of items of the tender can be carried out on negotiation with the tenderer before accepting any tender, so, that the rates can be brought down to workable rate. At present, there is no clause or condition to this effect in the PWD system of contract. A clause can be introduced.

(2) In major Projects, a clause of Performance Security has to be included. The clause shall be that the successful tenderer shall furnish to the Employer a Performance Security in the form of Bank Guarantee in an amount of equivalent to 10% of the Contract Price in addition to the normal Security Deposit of 10% of the Contract amount.

(3) If the tender of the successful tender is seriously unbalanced by more than the amount of the Performance Security, the employer may require that the amount of the Performance Security set forth in the clause above be increased as the expense of the successful tenderer to a level sufficient to proceed the Employer against financial loss in the event of the subsequent default under the contract.



## 6.4 THE ROLE OF PROJECT LEADER

Project Management is an assignment full of uncertainties and challenges. It is the commitment and dedication of the project Leader that determines the effectiveness and efficiency of any construction project. The Project Leader responsible for it is the main figure in the context of Project Management. So the implementation of any result oriented construction programme should be entrusted to a committed and dedicated Project Leader who has adequate managerial competence and dynamism. To be really effective he must possess the following qualities.

- (1) Leadership
- (2) Clarity of the goal
- (3) Credibility
- (4) To be limited extent
- (5) Capable of inspiring trust and confidence in his subordinates
- (6) Communication capabilities
- (7) Man management and team building
- (8) Technical competence
- (9) Capacity to anticipate likely problems/ hold ups and pre-empting/ catering for the same
- (10) Charismatic and dynamic

In the successful completion of the projects selected for case studies viz.

- 1) International Stadium,
- 2) Legislative Complex and
- 3) International Airport at Nedumbassery

The role played by the respective Project Leaders has been emphasised. Achieving the daily targets without slippage and within the budgeted inputs and resources is the only sure way to avoid over runs. Practical application of this concept is simple but calls for assiduous co-ordination and follow-up by the Project Leader throughout the project period. The Project Leader should build his team as a well- knit

unit, eliminate or control conflicts, induce motivation and boost the morale by his leadership style to develop a favourable work climate. Such an environment, no doubt, will produce effectiveness with efficiency in performance as revealed in the case studies conducted.

### **6.5. HUMAN DIMENSIONS – A MUST FOR IMPROVED DYNAMISM**

It is often believed that if CPM or PERT chart is made for any project and monitor the progress of the work, the project can be implemented without any time and cost over run. But it is not true. It is forgotten for often that for the effective implementation of a project “something” other than engineering expertise is required. That “something” is the Human Dimensions which is absolutely required among team members of the project.

### **6.6. EFFICIENT PROJECT MANAGER**

For ensuring successful realisation of a project, the project manager should be technically competent. The Project Manager has to look at the activities regularly and work carried out at site with a critical view so that timely corrective measures are taken to ensure both quality and progress. The implementation phase throws up several technical issues and problems. Solving them properly and also taking quick and bold decisions at site are the primary functions of a Project Manager. The project implementation can be performed effectively and efficiently, only when there is a strong project team and able leadership.

### **6.7 PRICE VARIATION CLAUSE IN TENDER DOCUMENTS**

Study of cost and time over run of any construction project is a part of construction management. The three dimensional criteria for successful management of engineering project are based on time, cost and quality dimensions. With respect to cost, the second dimension, it is rather difficult to complete a large work, which is likely to require more than one year for completion, within the estimate cost since the construction prices rise even faster than the rise in the consumer price index. Therefore

the concept of successful completion of project with the expected cost of completion within the estimated cost has to be changed to successful completion on the date of completion by adding the likely escalation in cost. Whether a project has been completed within the expected cost or not, can be rationally assessed by considering the estimated quantities and by evaluating the escalated rates for various items during the completion period. This also establishes a need to complete the project within the stipulated period of completion in order to minimize the effect of escalation. It will be appreciated to extend fair and equitable justice to both the employer and the contractor, by providing the price variation/escalation clause in the tender documents in such a way that disputes are minimised, speedy completion of work is ensured and overall economy in project cost is achieved.

The formulae used in CPWD viz.

$$VM = W \times \left( \frac{X}{100} \right) \times \left( \frac{MI - MIo}{MIo} \right) \dots\dots\dots(3.7.1)$$

$$VL = W \times \left( \frac{Y}{100} \right) \times \left( \frac{LI - LIo}{LIo} \right) \dots\dots\dots(3.7.2)$$

$$VF = W \times \left( \frac{Z}{100} \right) \times \left( \frac{FI - FIo}{FIo} \right) \dots\dots\dots(3.7.3)$$

Can be adopted to be included in the tender documents of State PWD.

## 6.8. A REVISION IN THE LAND ACQUISITION ACT NEEDED

The case study in respect of the Project – Cochin International Airport at Nedumbassery emphasize the need of a revision in the present Land Acquisition Act 1894 or legislation of a People – friendly Land Acquisition Act. In this context, the hardships caused to the people of Nedumbassery when more than 1300 acres of land were acquired and the turbulent phase was faced by those involved in the project implementation, should be an eye-opener to the Government of India. The revision should envisage increase in compensation, reduction of delays caused by disputes over

claims, tackling of resistance from oustees to the acquisition and more importantly, ensuring that the rehabilitation package reaches the beneficiaries in time. It would settle permanently the dispute and will also ensure timely completion of acquisition of land by the project implementing agency, the state Government and the district administration.

## **6.9 INTRODUCE A SYSTEM OF KEEPING HISTORY SHEETS OF CONTRACTORS**

At present, in almost all government departments, the work tendered is awarded to the contractor who bids the lowest. The efficiency, reliability or competence of the contractor is not evaluated and taken into consideration while awarding the work. The government departments do not have any discretionary powers and at times, knowing fully well that the contractor is neither competent nor reliable, the engineer is left with no choice but to award the work to him. If the engineer is given discretionary powers, there could be allegations of arbitrariness or favouritism unless there are established means by which the desired qualities of the contractor is quantified and best contractor adjudged. The personal error on the part of those who award the work should also be avoided. For both these, some suggestions are presented below.

It is necessary to keep on record the performance of each contractor especially his promptness and quality of execution. For that, a system of keeping history sheets has to be introduced in P.W.D. Just like a passport or registration card, each contractor can keep a history sheet book. It should be maintained in sanctity and will have to be produced as and when required to be verified by any engineer vis-à-vis the selection of a competent contractor. In the history sheet, all the details such as works executed, works in hand, time taken by the contractor to complete the work against its scheduled time, etc. shall be recorded. . This history sheet can be made use of for the issue of tender forms when tenders are floated for the execution of works. After tender opening also, a review of the performance of each contractor based on this history sheet can be made, before final decision is taken to award the work. For the monitoring and evaluation process also, the history sheet can be referred. The entry of any thing in this book shall be by the Executive Engineer, who is the actual executor.

This system can be like a licensing of contractors with a mention on the license of the quantum of orders received and recording other details. To know whether the contractor has executed the work within the scheduled time of completion or not, what the engineer need is to refer his history sheet. By introducing this system, not only registration, but also competence and capacity of the contractor as well as his performance are kept in view before a considered decision is taken.

When this system is attempted to be introduced in P.W.D., some legal problems may arise. They may have to be sorted it out by the Government.

#### **6.10. THE UNDESIRABLE CONTRACTOR SHOULD BE ELIMINATED**

If the history sheet of a contractor shows that he is frequent litigant and undesirable, he should be eliminated. If the history sheet shows that he has gone for Arbitration number of times, he will not have time to attend to his work. He will try to make evidence to go for arbitration again. He may not be interested to complete the work in time. The Executive Engineer has to record the reasons for the elimination in writing. If the tender is on a two cover system and if the technical bid or history sheet indicates that the contractor has gone for litigation number of times and undesirable, causing trouble to the department hindering the smooth execution of the project, his cover of price-bid need not be opened.

## REFERENCES

1. Abdul Salam, V.H. (1992) "Housing Scenario in Greater Kochi Region" *The Dream City of Cochin*, published by RECCAA., pp 22-25
2. Abdul Salam, V.H. (1989) "Building Economics in the Housing Sector", M. Tech. Thesis.
3. Ahuja, H.N. (1980) "Cost Control under Management Contracts". *Construction Management and Engineering*, Wiley Inter science Publication, USA.
4. Ananthanarayan, K. Kalyanasundaram, P. (1991) "Management Techniques in Indian Construction Industry - A Questionnaire Survey" *Journal of the Institution of Engineers (India)*, Volume 72, September, pp 73-75.
5. Ananthanarayanan, K. and Abhilash. P.J. (1999) "Resource Constrained Scheduling Techniques for Multiple Projects" *Journal of the Institution of Engineers (India)*, vol. 80, May, pp 33-36.
6. Austen, A.D. & Neale, R.H. (1992) "Managing Construction Projects" *Technorama, supplement to the Journal of the Institution of Engineers (India)*, Oct - Dec., pp 44.
7. Barath, B.N (1998) "Demolition of Unauthorised Buildings in Urban Local Bodies" *Journal of the Institution of Engineers (India)*, Vol. 79. December, pp 143-144.
8. Chatterjee, A.K. (1989) "Science, Technology and Spirituality" Impact on Quality of Human Life" *Journal of the Institution of Engineers (India)*, Volume 39, September, pp 11-14.
9. Chauhan, R.L. & Chen-Wei, (1990) "Quantitive Performance Evaluation Model" *Journal of the Institution of Engineers (India)*, Vol. 7, July, pp 31-42.
10. Chauhan, R.L. (1990) "Identifying Probability Distributions for Tunnel Cycle Time" *Journal of the Institution of Engineers (India)*, Volume 71, May, pp 13-17.
11. Chowdhury, S.R. (1988) "Growth of Public sector and its impact on the Engineer and the Profession" *Journal of the Institution of Engineers (India)*, Vol. 37, April, pp 1-3.

12. Cruz, J.D. (1992) "Contract Management and Arbitration in civil Engineering projects," *Journal of the Institution of Engineers (India)* Vol. 41, March., pp 11.
13. Datta, T.K. (1986) "Quality control clause in civil engineering contract" *Journal of the Institution of Engineers (India)*, Volume 36, November 1985-January, pp -171-172.
14. Dev, B. (1988) "Design Concept and Construction of Salt Lake Stadium - World's largest composite Sports Complex", " *Journal of the Institution of Engineers (India)*, Vol. 38, August, pp 10-13.
15. Duncan Wallace, I.N. (1970) "Fluctuation Clauses", *Hudson's Building and Engineering Contracts*, Sweet & Maxwell,.
16. Gajria, G.T. (1979) "Fluctuation clauses" Law relating to *Building and Engineering Contracts in India*, Second Edition.
17. Ganesan, N. (1990) "Application of Ferro-Cement in the low cost construction technology", *Nirmithi Compendium* - 1, Kerala State Nirmithi Kendra, Thiruvananthapuram.
18. Halpin Daniel, W and Woodhead Ronald, W. (1982) "The Construction Management Approach", *Construction Management*, John Wiley & Sons Publications, USA.
19. Irani, J.J. (1992) "Total Quality Management - the Indian Experience" *Journal of the Institution of Engineers (India)*, Vol. 41, January, pp 33-34.
20. Issac, Wc & Mangal, B. (1995) "Cost Effectiveness through Construction Management in Housing Construction" *Journal of the Institution of Engineers (India)*, Vol. 75, March.
21. Jain, S.P. (1993) "Monitoring Process in the Implementation of a Project" *Journal of the Institution of Engineers (India)*, Volume 76, August, pp 46-51.
22. Jain, S.P. (1995) "Evaluation Process in the Implementation of a Project" *Journal of the Institution of Engineers (India)*, Volume 74, November, pp 46-51.
23. Joshi, L.S. (1987) "Analysis of Cost and Time Overrun of a Project for improved Dynamism in Construction Management" *Journal of the Institution of Engineers (India)*, Volume 68, July, pp 4-9.

24. Joshi, L.S. (1988) "Discussion on Analysis of Cost and Time Overrun of a Project for Improved Dynamism in Construction Management." *Journal of the Institution of Engineers (India)*, vol. 68, January, pp 166.
25. Kalyana Sundaram, T. and Natarajan, P. (1992) "An Analysis of Indian Tenders" *Civil Engineering & Construction Review*, January, pp 33-37.
26. Kavanagh, T.C. Frank Muller and Brien James J.O. (1980) "The Construction Process and the Construction Manager". *Construction Management - A Professional Approach*, McGraw Hill Book Company.
27. Loomba, R.A. (1986) "Need for changes in Administration structure", *Journal of the Institution of Engineers (India)*, Vol. 36, July - August, pp 1-4.
28. Majumdar A.K. (1997) "Innovative Approach to cost Reduction in Construction", *Journal of the Institution of Engineers (India)*, Vol. 78, May, pp 42-43
29. Majumdar Prabir, K.R. and Manojsharma (1996) "President Dedicates Cochin Stadium to the Nation". *Nirman Bulletin*, House Journal of HSCL, Calcutta, November 1995 - April, pp 48-63.
30. Mallic, D.V. (1992) "Poor Construction Supervision in Developing countries - A Concern for Concrete Strength Serviceability and Durability", *Journal of the Institution of Engineers (India)*, Volume 73, September, pp 68-73.
31. Marsh, P.D.V. (1969) "Variation in Price and Time" *Contracting for Engineers and Construction Projects*, Gover Press, London.
32. Nagabhushana Rau, (1992) "A. Status of Construction Sector in India". *Journal of the Institution of Engineers (India)*, Vol. 41, January -, pp 35-46.
33. Nagabhushana Rau, A. (1989) "Improvement of Construction Technology" *Journal of the Institution of Engineers (India)*, March, pp 285-288.
34. Nagabhushana Rau, A. (1995) "Construction in Eighth Plan-Approach of the Planning Commission", *Journal of the Institution of Engineers (India)*, Vol. 76, August, pp 112-114.
35. Narayana Iyengar B.R., (1986) "Towards National Advancement" *Journal of the Institution of Engineers (India)*, Vol. 36, September, pp 1-4.



36. Narendra Singh, (1998) "Execution of Projects" *Project Management and Control*, 1<sup>st</sup> Edn. Himalaya Publishing House, Mumbai, , pp 203-331.
37. Panda A.K. (1992) "Construction Management and Site Work" *Journal of the Institution of Engineers (India)*, Vol. 73, July, pp 29-32.
38. Panda, A.K. (1996) "Some Action Points to for Speedy Implementation of Projects to Avoid Cost Overrun", *Journal of the Institution of Engineers (India)*, Vol. 77, November, pp 167-169.
39. Parua, P.K. (1996) "Use of fly-Ash in River Bank Protection Works" *Journal of the Institution of Engineers (India)*, Vol. 76, March, pp 209-213.
40. Pritam Singh Hans, (1978) "Construction Planning" *Construction Management & P.W.D Accounts*, Parkash Brothers, Technical Publishers, Ludhiana.
41. Raman, H. Mohan, S. & Sunil Kumar, N. (1996) "Development of an Expert System for Flood Management" *Journal of the Institution of Engineers (India)*, Vol. 77, May, pp 56-62.
42. Ramanathan, T.K. (1991) "Introducing the Construction Management concept" *Civil Engineering & Construction Review*, November, pp 12-13.
43. Ratnam, C.V.S. (1986) "The Eluding Technological Self-Reliance", *Journal of the Institution of Engineers (India)*, Vol. 35, April, pp 1-10.
44. Salam, V.H.A. & Jose, B.T. (1995) "Low-cost Housing Technologies - an Analysis of the Actual Cost Effectiveness" *Journal of the Institution of Engineers (India)*, Vol. 76, August, pp 86-87.
45. *Schedule of Rates 1978*, Public Works Department, Government of Kerala.
46. *Schedule of Rates 1980*, Public Works Department, Government of Kerala.
47. *Schedule of Rates 1982*, Public Works Department ,Government of Kerala.
48. *Schedule of Rates 1986*, Public Works Department, Government of Kerala.
49. *Schedule of Rates 1990*, Public Works Department, Government of Kerala.
50. *Schedule of Rates 1992* , Public Works Department, Government of Kerala.
51. *Schedule of Rates 1996* , Public Works Department, Government of Kerala.
52. *Schedule of Rates 1999*, Public Works Department, Government of Kerala.

53. Shamsheer Prakash, (1985) "New Building Materials and Construction Techniques for Economical and Speedy Construction" *Lectures on Housing*, published by CBRI, pp 69-75.
54. Sodhi, N.S. (1993) "Upgradation of Professionalism in Government Construction" *Civil Engineering & Construction Review*, New Delhi February, pp 15-18.
55. Som, N.C. (1994) "Price Variation Clause in Tender Documents in Construction Industry" *Journal of the Institution of Engineers (India)*, Vol 75, May, pp 50-53.
56. *Standard Data Book, (1965)*, Public Works Department, Government of Kerala.
57. Subba Rao, V.V. (1988) "Construction in National Development", *Journal of the Institution of Engineers (India)*, Vol. 72, September, pp 53-56.
58. Tenah Kwaku, A and Guevara Jose, M. (1985) "Future of Construction Management", *Fundamentals of Construction Management and Organisation*, Reston Publishing Co., USA.
59. Thomas Poullose, K. (1988) "Cost reduction in Housing Development", *Innovative Approaches to Housing the Poor*, B-8, Jawahar Nagar, Trivandrum.
60. Tonau Osatake (1991) "Challenge to Technological Innovations in Telecommunication" *Journal of the Institution of Engineers (India)*, Vol. 41, November, pp 5-7.
61. Vasada, B.J. (1994) "Performance for Engineering Contracts" *Journal of the Institution of Engineer (India)*, Vol. 75, August, pp 66-71.
62. Venugopalan, A.S. (1988) "Discussion of Analysis of Cost and Time Overrun of a Project for Improved Dynamism in Construction Management" *Journal of the Institution of Engineers (India)*, Vol. 68, January, pp 166.
63. Wiest Jerome, D and Levy Ferdinand, K. (1991) "PERT and CPM", *A Management Guide to PERT/CPM*, Prentice Hall of India, New Delhi, pp 1-4.
64. Zacharia George, (1993) "Factors of affecting Time and Cost overrun in Construction in India": An Analysis", *Souvenir of the Institution of Engineers (India)*, Cochin Local Centre, August, pp 1-9.

**11. (a) List of Papers published**

- (i) "Low-cost Housing Technologies - an Analysis of the Actual Cost-Effectiveness", *Journal of the Institution of engineers (India)*, Vol.76, August 1995.
- (ii) "The International Stadium at Cochin", *Platinum Jubilee - Souvenir of the Institution of Engineers (India)* 1996.
- (iii) "Housing Scenario in Greater Kochi Region", *The Dream City of Cochin* Published by RECCAA, 1992.
- (iv) "A National Dream - The International Stadium at Cochin", *Silver Jubilee - Souvenir of the Kerala Public Works Department*, 1995.

**(b) List of Papers accepted for publication**

- (i) "Laurie Baker's Approach to Cost Reduction in Housing", accepted by *Civil Engineering & Construction Review*, New Delhi.
- (ii) "Traits of Successful Project Leader for Better Effectiveness" accepted by *Civil Engineering & Construction Review*, New Delhi.