

SOME ASPECTS OF PROJECT CONTROL BY MAJOR CONTRACTORS - A REVIEW

by

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Abstract

This paper presents the details of a study carried out to review the present practice of some aspects of project control adopted on building sites by major local contractors. The study is based on an interview questionnaire survey carried out on 36 construction sites covering 18 Grade I contractors and 11 Grade II contractors.

The results indicate that most construction managers on site do not provide sufficient emphasis on project control. A considerable proportion of them are not aware of the proper techniques available for various aspects of project control and the extent of the benefits that can be obtained. The results also indicate that lack of a systematic approach in the organisations, lack of staff and resulting overload of work are the main causes of poor project control. The status of application of various project control techniques, record keeping, site routines and site office routines together with the personnel responsible for these routines are documented and discussed as an attempt to make the practitioners aware of the present practice. Finally, recommendations are made to improve the situation.

1.0 Introduction

The need for effective and efficient site management is becoming increasingly important to meet the present day challenges in the construction industry. One of the most important tasks in this endeavour is to adopt a suitable site management structure with qualified staff at key positions. The results of a study carried out to review the present practice of forming site management structures by major contractors in Sri Lanka are discussed in a separate paper (Jayawardane 1997).

In addition to forming efficient site management structures, application of proper project control techniques is essential for project success. Although there is nothing one can do to guarantee a profit, effective project control is one of the foremost factors

which contributes a long way towards making a profit a near certainty (Kharbanda 1980). With regard to project control, planning, scheduling and controlling of the operations and resources are the most challenging tasks faced by the construction managers (Seeley 1993). It is, therefore, essential to adopt systematic procedures to ensure that thorough, accurate and regular checks are made for all aspects of project control for successful completion of a project.

This paper presents the details and the results of a study carried out to investigate the present practice of project control as an extension to the study on the formation of site management structures. The scope of the study includes progress control; cost control; stores management and waste control; status of record keeping; and also how the contractors set about to execute various site and site office routines. The study was aimed at to investigate the extent to which these project control measures are practised rather than an in depth study to critically examine the merits and demerits of the techniques adopted.

Quality aspects were not included in the study considering the fact that the time, cost and wastage cause far more direct impact on the project success from the contractors view point. Safety management was also excluded since a detailed study on safety, health and welfare has been carried out recently (Jayawardane 1996).

2.0 Methodology and Data Collection

First, a thorough literature survey was carried out as background information to understand the site management practice including various project control techniques, important records maintained at site, and various site and site office routines.

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Second, interviews and discussions were held with heads of construction sites using a well structured questionnaire. This method was selected as the most suitable to capture details on present practice of project control because it enables to have interactive discussions to obtain (a) first hand information on the subject under study, (b) detailed explanations and justifications for various opinions and decisions, and (c) a 100% response rate.

The emphasis was given to Grade I contractors since they have the necessary know-how and expertise for effective project control which can then be used to test the industry status. However, it was thought appropriate to cover a sample of Grade II contractors as well to establish whether there are any similarities and variations between the two grades.

The sample included all Grade I contractors, a sample of Grade II contractors and a representative sample of their sites. The extent of coverage was limited to the

Western Province since a very big proportion of Grade I and Grade II contractors and their sites are based in that Province and also by considering the difficulties in covering the outstation contractors and sites.

After a pilot survey carried out with three Grade I construction managers prior to finalising the questionnaire, a well structured interview questionnaire survey was adopted for data collection so as not to miss any essential information and to avoid unnecessary details. In order to make sure that sufficient and necessary data are collected through discussions to fulfil the study objectives, a pilot data analysis was carried out after interviewing 5 Grade I contractors. Subsequently, necessary improvements were incorporated to the final questionnaire. This way, 18 Grade I contractors, 11 Grade II contractors covering 36 building sites were studied in the data collection. The details are given in Table 1.

Table 1 Details the contractors and sites used in the study

Contract or No:	Grade	Sector	Type of Building	Approximate Cost (Rs. m)
1	I	Private	Hotel	200
			Institution	80
2	I	Private	Housing	90
			Institution	25
3	I	Private	Hotel	250
			Housing	80
4	I	Private	Housing	70
			Office	45
5	I	Private	Hospital	50
			Office	35
6	I	Private	Office	65
			office	40
7	I	Private	Housing	75
			Housing	60
8	I	Private	Office	30
9	I	Private	Shopg.Complex	25
10	I	Private	Office	20
11	I	Private	Factory	9
12	I	Private	Office	35
13	I	Private	Housing	45
14	I	Private	Housing	40
15	I	Private	Factory	6
16	I	Private	Office	20
17	I	Private	Office	25
18	I	Private	Office	30
19	II	Private	Housing	65
20	II	Private	Hotel	40
21	II	Private	Office	15
22	II	Private	Housing	25
23	II	Private	Hospital	20
24	II	Private	Hotel	25
25	II	Private	Office	20
26	II	Private	Shopg.Complex	28
27	II	Private	Office	24
28	II	Private	Factory	4
29	II	Private	Factory	8

Third, the data were compiled and statistically analysed to review the present status and practice of project control.

3.0 Status of Project Control on Building Sites

Management of a construction site involves several distinct, complete and routine activities. Some of the main activities are planning; resource allocation; progress control; purchases and stores control; co-ordination and communication; execution of work; quality control; and accounting work. Clearly, effective site management involves the use of proper systems and procedures for these routine control activities. It means to decide on the persons involved, standard forms to be filled, tools and techniques to be used, and records to be maintained. A system is a planned approach to achieve a goal and consists of various inter-related and interdependent activities called procedures.

The status of the Sri Lankan industry in carrying out these project control aspects are summarised below.

3.1 Progress Control

Progress control, which is one of the most important control aspects, consists of taking systematic steps to ensure that the original construction programme is followed as closely as possible throughout the project. In order to achieve this, it is essential to introduce an adequate and accurate data capturing procedure for the work executed under the operations contained in the programme. Although all the contractors surveyed claimed that they carry out effective progress control, in depth analysis revealed the following.

- (a) Sixty percent of the contractors carry out progress review weekly, 30% fortnightly and the balance monthly.
- (b) Thirty percent of Grade I contractors adopt standard formats to measure and record weekly progress. Others adopt various ad hoc recording methods.
- (c) Only one Grade I contractor makes use of photographs taken monthly as a progress monitoring tool in addition to standard formats for all his projects. This information is properly documented and submitted to client/consultant for information and comment.
- (d) Although all contractors claimed that they use bar charts to monitor progress, updated bar charts were observed only on 27% of Grade I

contractors' sites and 9% of Grade-II contractors' sites. Other sites had bar charts without updating for several weeks or months.

3.2 Cost Control

The objective of any cost control system is to ensure that the project meets its cost targets throughout the project period. This is achieved by comparing estimated costs with actual costs and taking corrective measures when necessary. The status of the Sri Lankan industry with regard to cost control is as follows.

- (a) Only 50% of Grade I contractors and 9% of Grade II contractors surveyed practice cost control on site. Out of the 18 Grade I contractors surveyed only one contractor collects cost data daily, two collect weekly and the rest collect monthly.
- (b) All contractors who carry out cost control on sites, use some form of standard format to collect cost data. Most of the other contractors claimed that they do not check cost variance at frequent intervals using standard formats but compare the actual expenditure against estimated at valuation period (monthly) and take corrective actions.
- (c) The collected cost data are normally analysed at the head office and any corrective actions are communicated to sites.

3.3 Stores Management and Waste Control

It was found that all the construction sites visited had some kind of a store under a Store Keeper. Material issues and returns are properly maintained by standard records such as stores ledger, inventory register, bin cards/stores ledger cards register, purchase order, goods received notes, material requisition notes and transfer notes.

However, the measures adopted in controlling site wastage seem to be totally inadequate. The contractors who make an attempt to reduce wastage concentrate more on material and machinery usage. Only two Grade I contractors and one Grade II contractor surveyed had some kind of a material reconciliation system to investigate material wastage at site. More than 50% of the construction sites visited had inadequate storage facilities and lack of tidiness.

A reader interested in further information on the status of material and labour wastage on construction sites can follow it up elsewhere (Jayawardane 1992, 1994) where a comprehensive study has been carried out on this subject.

3.4 Other Site Procedures

1. General administration and personnel management

This normally includes recruitment of workers; identifying required training; keeping personal records, attendance and leave entitlement; taking disciplinary actions and so forth. These aspects are generally handled by the site head with the assistance of the site clerk/cashier. Provision of job descriptions and performance appraisal are also a part of the general administration which are not generally carried out by local contractors.

Findings of the survey indicated that every site has an attendance register for site office staff and field officers. Attendance of direct labour is marked in the project check roll by the site head's nominee before commencement of the day's work and after lunch which is then transferred to master check roll by the site clerk/cashier before the close of the day. Site heads are permitted to recruit site workers but not site staff.

2. Finance and Accounting

Site Manager/Resident Agent is also the finance/accounts manager at site who is assisted by the clerk/cashier. They are responsible to collect and settle petty cash, cash imprest, special cash etc. from the head office and are responsible to maintain files and registers dealing all of the above.

It was found that general accounts procedures are the same among the contractors although the limits of petty cash, cash imprest and other purchases differ significantly. All the contractors maintain standard formats and procedures at sites for settlement of petty cash and other reimbursable money. Payments to sub-contractors are always made at the head office with the recommendation of the site head. All wages and salaries of site staff and workers are prepared at the head office based on the details given by the site clerk.

3. Co-ordination and communication

Construction involves many professionals from various organisations and a large volume of information passes between them during project execution. One of the most important modes of communication is through site meetings and hence this aspect was looked into in greater detail. During the course of construction, a variety of meetings take place at site. Some are called at short notice to resolve urgent problems whilst the others are formally arranged at regular intervals and concerned with co-

ordination and progress. Table 2 shows the frequency of conducting formal site meetings by parties involved for medium-large projects.

**Table 2 -
Frequency of conducting formal site meetings**

Site meeting frequency	Status (%)	
	Grade I	Grade II
Weekly	50	9
Fortnightly	27	55
Monthly	22	36

These meetings are attended by the main contractor, consultants employed by the client, and the clerk of works or the Resident Engineer. Meetings are conducted in a formal manner in accordance with an agenda set out before hand and minutes circulated among the parties by the lead consultant. The contractor is represented by the site manager and the person who co-ordinates between the site and the head office. Site Engineer and other staff participate whenever necessary. A typical agenda used for a site meeting for a medium-large project is given in Table 3. However, there can be significant variations in this type of an agenda depending on several factors, in particular, type of contractual arrangement. An action column is also generally included in the minutes to avoid confusion as to who is responsible for the items minuted.

Table 3 - Agenda for a typical site meeting

Item No.	Agenda item description
1.1	- Record of personnel attending.
1.2	- Confirmation of minutes of pervious meeting.
1.3	- Matters arising from previous minutes.
1.4	- Confirmation of matters raised at
1.5	intermediate site visits by consultants.
1.6	- Progress review, report on progress position, plan of future action
1.7	- proposed by the contractor, report from clerk
1.8	of works 1.8or resident engineer.
1.9	- Drawings and information requirements.
1.10	- Queries relating to construction materials or design.
1.11	- Anticipated future requirements and outstanding problems.
1.12	- Sub-contractors' problems.
1.13-	Variation orders - confirmation of instructions.
	- Financial review -quantity surveying matters.
	- Any other problem.
	- Date and time of next meeting.

All these meetings except contractors internal meetings with their sub-contractors, are mainly aimed at external project control by clients or their representatives. However, they indirectly help the contractor for his own project control in two ways. First, the fact that the contractor should present the project progress to client, consultant or project manager together with sound justifications for failure to meet the planned progress, and the embarrassment faced by the contractor to come out with similar excuses all the time, compel the contractor to do something to meet his progress targets. Second, the opportunity given to contractor to present reasons, justify constraints and point out requirements to be met by other parties enables the contractor to reduce his costs.

3.5 Record Maintenance on Site

Record keeping is an integral part of successful site management and project control. Proper records are the basis for many decisions taken to resolve complex situations, justify claims, resolve disputes and so forth. The following are some of the important records maintained at site and a brief description of each of them is provided for convenience of the reader.

1. **Method Statement:** This is prepared by the planning engineer during the pre-tender stage indicating in detail the methods and sequence of construction to be executed, details of all temporary works, plant, equipment and labour requirements and so forth. Maintaining of these records at site helps site personnel to take many decisions without deviating from the planned method. Furthermore, proper recording of the actual methods adopted can also be used as feed back to the planning engineer to develop improved method statements for future projects.
2. **Site Diary:** This provides a complete narrative of the progress of days work, activities and events. Typically, it gives factual records of details of work in progress and their locations; any arguments regarding quality of workmanship; notes of weather and time lost; names of the visitors to site; worked hours; details of complaints made by client, consultants and public; and other important information like accidents, disputes and so forth.
3. **Variation Orders:** Typical examples to originate variation orders include unforeseen ground conditions, non availability of specified components and change of client's requirements. These variations along with amended drawings and specifications must be properly maintained

to prepare claims and also to solve many contractual disputes which might arise in the future.

4. **Labour, Plant and Material Returns:** These generally contain numbers and categories of labour and plant; operating time; idle time and reasons; fuel pumped, breakdowns and maintenance of plant; and materials received dates, quantity used and balance. Site manager is normally required to submit periodic reports of these details to the head office at prescribed intervals such as weekly/fortnightly.
5. **Daily Progress Report (DPR):** This is a summary of days work including daily progress; material, men and machinery used; weather conditions; over time hours and reasons and so forth. If properly maintained, DPR serves in many ways, for example, for standard norms analysis, unit cost analysis, performance analysis and progress monitoring. It also helps site managers to prepare weekly/fortnightly site reports.

The status of maintaining these records by major local contractors is shown in Table 4. It is surprising to note that none of the Grade I and Grade II contractors surveyed maintain proper method sheets. Furthermore, maintaining of a Site Diary and Daily Progress Reports were also found to be very unsatisfactory.

Table 4 - Status of record maintenance by major contractors

Records	Status (%)	
	Grade I	Grade II
Method sheets	-	-
Variation orders	100	55
Daily progress report (DPR)	1	19
Site diary	-	9
Plant/material return	55	9

3.6 Site and Site Office Routines

Clearly, the contractor needs collective response from the site team to achieve his goal effectively. Full participation of every individual assemble at site is indispensable. It is therefore necessary to adopt a proper and equitable division of work among the site personnel, in particular, the routine activities. Table 5 and 6 illustrate general site routines and site office routines of the local contractors and the personnel responsible for these routines.

Table 5 - General site routines and persons responsible

Routine		Responsibility
1.	General Site cleanliness and drainage Blowing up times Opening Site security	Site Engineer/ All Supervisors Site Clerk/Time Keeper site entrance Security Site Manager
2.	Technical Supervision of work Setting out and levelling F/W and support design Shop drawing preparation Bar bending schedules	Site Engineer/ Assistant Site Engineer Site Engineer
3.	Quality Control Work supervision and rectification Material testing and reports Material stocking and maintenance	Site Engineer/ All supervisors Site Engineer Site Manager/Store-keeper
4.	Temporary Structures Making access road for construction site and all necessary temporary structures and fences	Site Engineer
5.	Safety at Work Work inspection according to the safety regulation and placing warning notices	Site Manager/ All supervisors
6.	Productivity and Wastage Work inspection, material returns, material reconciliation etc. Work study and Method study	Site Engineer Site Engineer
7.	Plant and Machinery Plant return preparation, arrangement of required plant etc. Daily maintenance of plant and equipment	Site Manager Site Manager/Foreman
8.	Sub-contractor Work Allocation of work Work supervision and material arrangements Bill certification and forwarding Sub-contractor co-ordination	Site Manager Site Engineer Site Manager/Site QS Site Manager

It can be seen in Tables 5 and 6 that the Site Manager is in fact overloaded with a lot of routine activities, some of which can easily be delegated to other site staff. For example, the daily maintenance of plant and equipment, involvement in maintaining records such as materials and plant returns; and perhaps methods sheets can be delegated to suitable subordinates for him to concentrate more on project control and co-ordination activities. In fact, this is specially important because most construction managers claim that they do not have sufficient time to concentrate on serious project control but to get on with actual construction.

3.7 Causes of Lack of Project Control

Site Managers and other site staff who are responsible for carrying out project control and related data collection were asked to indicate the causes of lack of project control, if any. Statistical analysis showed that there is no significant correlation between these causes and the project parameters such as type of client, type of building and value of project. However, these causes were separately analysed for Grade I and Grade II contractors for comparison. The results can be summarised as shown in Table 7.

Table 6 - General site office routines and persons responsible

	Routine	Responsibility
1.	Personnel Management Time and wages sheets Leave approvals Roster for work supervision	Site Manager/Site Clerk Site Manager Site Manager
2.	Financial and Accounting Petty cash settlement Cash reimbursement Accounting work	Site Manager/Site Clerk Site Manager Site Manager
3.	Administration and Site Meetings Administration of site, conducting site meetings, communicating to personnel	Site Manager / Administration Officer
4.	Record Maintenance Method sheets DPR and Site Diary Variation orders Log notes and entries Contractual documents Material and plant returns	Site Engineer/Site Manager Site Manager Site Quantity Surveyor Site Manager/Site Engineer Site Manager/Site QS Site Manager
5.	Planning and Control Weekly planning Daily planning and allocation of material Progress control, Cost and waste control	Site Manager/Site Engineer Site Manager Site Manager/Site Engineer/Site QS

Table 7 - Causes of lack of project control

Cause	Status (%)	
	Grade I	Grade II
No proper system in the organisation	33	45
Less technical staff and more work	56	11
No such problem	11	9

4.0 Discussion and Concluding Remarks

The findings of the study indicated that the systems and procedures adopted by major local contractors for various project control activities are not satisfactory. Most of the site managers are action minded to somehow or other get the work going without realising the drawbacks of not adopting proper site procedures and project control techniques. The study also indicated that a considerable number of site managers are not in fact aware of the various project control techniques and the extent of the benefits that can be obtained.

It is also disappointing to note that a considerable proportion of contractors identify lack of systematic procedures in the organisation as the main cause of poor project control (see Table 7). This shows the indifferent nature of these contractors on this all important issue of project control. Furthermore, even a larger proportion of contractors claim that lack of technical staff and the resulting overload of work is the main reason for poor project control. This is because the majority of contractors attempt to employ the minimum number of managerial, technical and supervisory staff, sometimes without even proper qualifications, to reduce staff overheads. However, it is unfair to put the blame only on one party involved in construction. In our view, the entire construction culture and attitudes of all the parties need significant changes.

The solution should start with a sound method for contractor selection. The fundamental rationale behind competitive tendering, which is the most popular and sometimes the only way for contractor selection for most of our projects, is free market competition, i.e. genuine competition for the best value for money for the client. However, it is often implemented to the extreme, sometimes compelling the clients to accept the lowest bid, particularly in

state sector construction, even when the contractor selected has poor performance records. This factor compels even the reputed contractors to cut down overheads by employing the minimum number of technical staff to get on with the project sacrificing effective project control measures, without realising the benefits of proper project control.

To overcome some of these problems the following recommendations are suggested.

1. Development of a suitable contractor selection model acceptable all clients, in particular state sector clients, incorporating all significant contractor performance parameters, namely, technical capability, financial capability, past records and current work load, in addition to the bid value.
2. Stipulation of the minimum requirement of site management, technical and supervisory staff both in numbers and qualifications for various sizes and types of projects, and constant monitoring of this requirement throughout the project (not only at the contractor selection stage as at present).
3. Introduction of incentives to contractors, in particular private sector contractors, to encourage and facilitate young professionals to obtain advanced knowledge in construction management and related areas to keep abreast with the industry demands and to be aware of new tools and techniques.
4. Effective dissemination of knowledge by educational and research institutions on available project control techniques, tools and procedures and the extent of benefits that can be obtained. For example, by giving wide publicity for tools such as standard forms, formats and check lists published by the ICTAD (1990).
5. Facilitate the research institutions such as Universities, by making available sufficient research funds, to look into specific problems in the industry and make suitable recommendations for improvement. ICTAD being the construction industry authority is paying a leading role in this exercise but the allocation seems to be insufficient to make a significant impact.

5.0 References

- Anderson, S.D., Woodhead, R.W. (1983). Project manpower management, John Wiley and Sons, Inc., Canada.
- Barrie, S., Paulson (Jr), C. (1984). Professional construction management, John Wiley and Sons. Inc. NY.
- Bently, T. (1995). Organisational Management. Journal of Management Accounting. Vol. 73, No. 6, pp 38.
- Harlow, P.A. (Ed) (1977). Institute of Building. The practice of site management. Vol. 1, Paper by Pullan, E.J. "Management development and site management", pp 41-44.
- ICTAD (1990). Institute for Construction Training and Development, "Forms, formats and check lists" for the construction industry.
- Jayawardane, A.K.W. (1992). "Wastage on building construction sites - what the Sri Lankan contractors say". Proceedings of the Annual Sessions of the Institution of Engineers Sri Lanka, Oct. 1992, pp 114-127.
- Jayawardane, A.K.W. (1994). "Are we aware of the extent of wastage on our building construction sites?". Engineer, Journal of the Institution of Engineers Sri Lanka, Vol.XXII, No 1, pp 41-54.
- Jayawardane, A.K.W. (1996). "Safety, health and welfare on construction sites". Engineer, Journal of the Institution of Engineers Sri Lanka, Vol XXIV, No 01, pp 01-10
- Jayawardane, A.K.W. (1997). "Organisation of site management for building projects" submitted for Engineer, Journal of the Institution of Engineers Sri Lanka, currently being reviewed.
- Kharbanda, O.P., Stallworthy, E.A., Williams, L.F. (1980). Project cost control in action. Gower publishing Company Ltd., UK.
- Panda, A.K. (1992). "Construction management and site work", Journal of Institute of Engineers, India, Vol. 73. Part CV2. pp3-7.
- Seeley, H. (1993). Civil engineering contract administration and control. Macmillan Publishing Co., Inc., NY.