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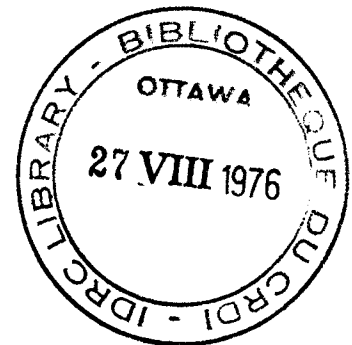
A paper on the Management and Effectiveness of Construction
Projects under International Development Programmes.

Part II of a final report to the International Development
Research Center on completion of a Research Associate Grant 1974-75
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CONTENTS

- Section 1. Introduction
- Section 2. Summary of Recommendations
- Section 3. Design with Regard to Construction Realities
- Section 4. Administrative Procedures and the Bureaucracies Involved
- Section 5. The Materials Problem
- Section 6. Manpower and Machinepower Management
- Section 7. Cost and Schedule Control
- Appendix 1. The Project Manager System
- Supplement - Comments on the Paper

INTRODUCTION

It is well known that development projects, either financed locally or by international development agencies, invariably overrun their estimates both in cost and time. It appears that the overrun on such projects is greater than on private construction and in many cases greater on internationally financed projects than those paid for with local resources. The extent and reasons for these overruns are not well documented (1) and various attempts by agencies have proved inconclusive due to a lack of standardized costing procedures, the influence of inflationary cost increases and a natural reluctance of all organizations to partake in postmortem examinations of their construction projects. (2)

It is also a recurring problem for both public agencies in developing countries and aid organizations to spend the capital funds available within their budget period. The reason for this is the excessive gestation period for development projects from approval of a project to work commencement and the delays experienced during the construction period once work is underway.

It is not the intention of this paper to quantify these increases in time and money but rather to discuss in general the various problems associated with such work and see how these overruns can be minimized. The various reasons for such problems have been appreciated for some time. In 1954 W. Lewis wrote: "It is surprising how frequently investment plans are frustrated merely by failure to ensure that the building industry can cope with the work which will be required of it....."(3) and in 1965 Walterson:- ".....unexpectedly high construction costs and long delays (due to) inappropriate specifications, poor siting, the use of defective or other improper materials and poor workmanship."(4) To these reasons can be added those of lack of standardization, inappropriate construction methods, and bureaucratic organizations not suited to the decision-making process involved in construction management.

(1) The work of the "Operations Evaluation Department" of the I.B.R.D. is of note in this area.

(2) The work of the "Operations Evaluation Department" of the I.B.R.D. carries out much needed review of development projects financed by that organization. However other attempts by the Bank to review cost data such as in their "A Review of 62 Road Appraisal Reports 1960-66 - Economic Dept. Working Paper #5" were frustrated largely by non-standardization of costing procedures.

(3) W.A. Lewis - Theory of Economic Growth.

(4) W.A. Walterson - Development Planning: Lessons of Experience.
John Hopkins Press Baltimore 1965.

There has been a notable lack of research in the field of administration of construction as compared with the work that has been done in such fields as design, the use of materials and other items which involve pre-construction decisions. Even in the field of economic planning and development, the majority of research has been into pre-construction decision making processes.

It is particularly evident to those involved in both the design and construction phases of development projects financed by international agencies that, though these agencies involve themselves extensively in such activity as feasibility studies, the appointment and control of design consultants, and other pre-construction work, the actual augmentation of the construction phase is usually left entirely to some recipient organization with only minimal financial control and a complete lack of on-site involvement by the financial agency. Yet it is the on-site expenditures that cause most of the cost overrun and the on-site administration (or lack of it) that often cause excessive delay to augmentation — costs and delay which, in the long run, more than make up for any savings that may have been realized by much of the pre-construction studies, consultants' reports, etc.

It is also not the intention of this paper to involve itself in the reasons for this apparent lack of concern, though from discussions with various agencies the problem is appreciated, and it appears that its solutions, as with most that are discussed in this report, are political and administrative rather than technical.

This paper is a rationalization of the present state of the art of construction management in development-oriented construction projects built through international agencies or with local financial arrangements. Within this framework an attempt is made to produce some generalized recommendations as to how the existing system can be used to try to reduce construction costs and delays.

Though it is appreciated that fundamental changes in the whole structure of government and/or industry may be one method of cutting down these inherent problems, this would require attempts to change attitudes — and ways of life that are not only outside the scope of this paper but of doubtful long-term effect. Recommendations have been made, therefore, to adapt rather than change, to accentuate the productive elements of the existing system rather than try to revolutionize the present methods.

Construction augmentation may differ in detail and in nomenclature between different countries and different areas of the developing world but the similarities are fundamental and the generalities discussed appear justified. The observations in this paper are, therefore, theoretically applicable to all construction activities, whether they be large or small, urban or rural, agricultural or industrial. Large construction projects, of a spectacular or complex nature, are, however, constructed on a one-time basis, often by international construction organizations and do not represent the average development scheme. This paper is concerned with smaller

continuing infrastructure type projects, such as housing, harbours and, because of the author's particular experience, rural roads and water supplies.

The problems encountered in augmenting construction in these types of projects appear at first study to be various, but on analysis can be broken down to the following broad categories under which they are considered in this paper:

1. Design with regard to construction realities.
2. Administrative procedures for construction and the bureaucracies involved.
3. The material problem.
4. Manpower and machine-power management. (Including labour-intensive construction.)
5. Cost and schedule controls.

The object of this paper is not so much to examine in depth each of these problems separately, but rather to consider the inter-dependence and inter-relationships that exist between these areas and to recommend (a) administrative procedures that will reduce the costs that are at present being experienced and (b) where necessary suggest areas that it would be advantageous to carry out more detailed research and study.

In order to produce a reference point for this study it is necessary to define in broad terms the purpose of overseas development aid. This in itself is a large and fertile field of study and much has been written on the subject. This paper tries to avoid as much as possible the various political, sociological, and philosophical discussions associated with this topic and, therefore, the assumption is made that the ideal is to construct a facility as economically and in as short a time as practical, considering the political and social constraint imposed on the people whose duty it is to augment the project. The educational or "missionary" aspect of overseas aid has not been considered of any but passing importance in this presentation.

The opinions and recommendations are the result of extensive personal experience in the management of construction in developing countries coupled with the study of various publications on this and related subjects and extensive interviews with government and agency officials, contractors, consultants and others directly involved with the augmentation and control of such projects.

With such varied and, in many cases- prejudiced sources of information, it is to be expected that the opinions gathered might be conflicting. An attempt has, however, been made to identify and rationalize a consensus of these ideas and produce a workable model that could provide an administrative vehicle for carrying out development construction for minimum cost in minimum time.

SUMMARY OF RECOMMENDATIONS

If the object of overseas development aid is to be considered as more than a handout of conscience money or missionary goodworks, but rather as an opportunity to provide facilities with which the recipient countries can increase their share of world-wide wealth, then one must be interested in providing these facilities as economically and as timely as possible. In order to do this the design of the facilities must be realistic in comparison to the financial and social conditions prevailing, the work must be carried out in a most expeditious way and one must be aware of the social and political realities within the country.

The responsibility for ensuring this action is not only that of the governments of developing countries, who are themselves beset with prejudices, dogmas and political expediencies, but also that of the financial institutions and agencies who are providing funds. It is in these latter organizations' interest to produce the largest impact with the limited funds available and, unless they are prepared to take the initiative in this field, they may as well ship out ten dollar bills for distribution at the local cross-roads.

The problems discussed within this paper are all administrative rather than technical and the principal solutions suggested are to simplify and standardize design and to put the responsibility and also the necessary financial, technical and managerial authority into the hands of one person (who is referred to as the project manager). At present these responsibilities are divided at best between many people within a single augmenting agency and at worst between a variety of governmental and non-governmental organizations within both the recipient and donor countries. There is no one man who can be given the directive and necessary power to get the work done on time with minimum cost outlay.

In more detail the recommendations put forward are as follows:

1. The design for overseas development projects must be standardized and simplified. Not only the physical design but also the specifications, tolerances, finishes and the legal requirements of construction must be standardized and simplified to allow advantage to be taken of pre-fabrication, repetitive structural construction and the use of local contractors.
2. The designers (and not just the firms for which they work) of such development projects must be chosen not only for their expertise in the technical aspects of their design but also for their experience in development work overseas in general, their knowledge of the local conditions and their willingness to learn from such experience and to undertake after construction evaluation as detailed below.

3. Full scale post-construction evaluations should be undertaken to identify the reasons for any cost and schedule overruns and to find the administrative or technical changes that can be augmented to minimize the future effects of these. This evaluation should be undertaken by a combined team consisting of the designers, the construction organization, the financial agency and the augmenting and operational agencies involved. The results of these appraisals should be as widely circulated as possible.
4. The construction management should be undertaken by a semi-autonomous construction manager or management team, reporting only at the highest level to the augmenting and financial agencies concerned. Such a project manager must have day-to-day control of all construction aspects of the project including labour, equipment, and supplies. He must also be given the necessary authority to carry out his prime responsibility to get the work done on time and at minimum cost. Suggested organizational and responsibility concepts of this position are outlined in the appendix to this report.
5. Development projects of an infra-structure nature should be undertaken by a modified direct labour concept under the direct control of the project manager as suggested in 4 above. Contracts should be limited to labour only, small unit-price type arrangements and specialized sub-contracts. Material acquisition and major equipment operation would come directly under the project manager's control.
6. Major consideration must be given to restructuring the present methods of equipment and material acquisitions, expediting and delivery. The use of government purchasing and shipping agencies (whether of donor or recipient countries) should be avoided. It is recommended that these duties be undertaken by the project manager with the necessary competent staff or outside commercial help provided.
7. Labour-intensive construction projects should also be administered under a direct labour arrangement with control of all aspects in the hands of the project manager.
8. Major construction equipment should be obtained by the project manager (by purchase or hire) and administered by him under the modified direct labour arrangement detailed in 5 above. Equipment should be of the multi-purpose type wherever possible and maximum utilization should be provided for by carry-over to additional projects where possible. Independent arrangement for the supply of spares should be made.
9. Reporting techniques designed to attain maximum control of cost and schedule fluctuations should be instigated by both the augmenting and the financial agencies involved in the project, and the system set up whereby the project manager has both the responsibility and authority to act on such reports.

10. Estimates of construction costs, whether prepared by design consultants, augmenting agencies or the financial organization's own staff should be evaluated by an independent construction engineer experienced in the social, physical and construction environment at the site of the work. Such evaluation should be based on a total time/cost method rather than unit prices.

Apart from the administrative recommendations detailed above there are certain aspects of the management of overseas development construction projects which in the author's opinion require further study and research. It is felt that such work would result in a better understanding of some of the basic problems involved and provide further detailed recommendations as to how such projects should be administered. The suggested study areas are as follows:

1. Further detailed study into the exact organizational form in which the project management concept should be formed in specific developing countries.
2. A study of the availability of qualified management personnel and supporting staff, within the service of developing countries' governments, within the international construction community at large and within private industry. Such a study should also obtain whether such people would be amenable to limited contracts as project managers as suggested in this paper and the conditions under which they would accept such positions.
3. Detailed study of a simple cost and schedule reporting system to provide the required advance information necessary for project management to mitigate the effect of fluctuations in anticipated costs and schedules.
4. A study of productivity factors for various skilled and unskilled labour in various countries and areas within countries. Such factors are already used extensively by international contractors in the estimating of overseas work and would be invaluable to the international financial organizations in evaluating estimates for and negotiating construction costs on development contracts.
5. A study, by a sociologist rather than an economist or an engineer, into the motivation of labour under labour-intensive construction conditions. Particularly the effect of a long term task-work on total productivity - and methods other than financial reward to stimulate productivity should be considered.
6. Further study of non-conventional methods of labour-intensive project management such as the Indian "Land Army" and the Philippine "Work Brigades" should be undertaken.

The problems that beset the implementation of overseas development construction projects will, naturally, continue despite the most ambitious management organization and the most dedicated personnel. It is felt however, that if a rational approach can be taken towards using these recommendations, which have already proven successful under various operating conditions, much of the excessive cost overruns and construction delays at present being experienced can be controlled and that the much needed projects can be built more economically and in a more timely manner.

DESIGN WITH REGARD TO CONSTRUCTION REALITIES

Any discussion on the cost of construction must start with the design of the structure - all too often design engineers, even those attached to the most experienced design consultants, have a very superficial knowledge of construction techniques and, though such designers will assure one of their continuing attention to the construction aspects of their designs, anyone who has experience with augmenting them can give extensive examples where designs have been, if not impossible to construct, at least could have been designed in a manner which would have allowed a more economical method of construction without loss of structural integrity. The concept that "concrete is cheaper than brains" is still very prevalent in the design industry. This problem is even more apparent in overseas development work, particularly with design organizations not intimately familiar with local construction procedures, customs and skill availabilities.

There are many such examples of design practices causing additional costs, some of the most obvious being the use of equipment and/or skills that are unavailable or in short supply in the area concerned, while others are more complex and in order to avoid, require an intimate knowledge of the local environment. Two examples, one obvious and one not so obvious, will suffice to show the type of problems that can be encountered and the additional costs they can involve:

While working in one of the smaller Caribbean islands some years ago the author had to install some pre-fabricated steel sections, the largest of which weighed about 5,000 lbs. - not a great weight to handle in a country where mobile cranes are obtainable. On this island there was, in fact, a crane capable of handling this section, it was however, permanently used in the harbour and to move it to the bridge site would have necessitated closing down the port for about a week. The sections were eventually installed using jacks and a front-end loader - however, the cost was greatly increased over that which would have been necessary had the sections been smaller.

Again in the Caribbean, at one of the larger islands, a water treatment plant was being built on an overseas aid programme, and designed by a well-known and competent Canadian firm of consultants. The step irons in all tanks, manholes, etc., were specified as being fabricated from 2½" extruded aluminum, - a standard no doubt in Canada. The local extruding plant on the island, however, could only extrude to a maximum of 2¼" which would have necessitated all step irons being fabricated overseas. In this case the contractor brought the matter to the attention of the field supervision who changed the step irons to 2¼" with considerable savings in both time and cost.

Similar to the additional costs and delays caused by inappropriate design is a common habit of design firms to use standardized designs for such minor structures as pump houses, manholes, culverts, etc. The problems with this practice are two-fold. Firstly many firms do no more than "change the title block", which in the case of designers whose majority of work is in temperate climates has led to the building of roofs to support snow loads in the tropics and relief valves capable of handling temperature variations of a hundred degrees in countries which may have temperature variations of only 10 degrees. Secondly, the organization receiving the structure is unable to develop its own standard structures as every design organization with which it comes in contact inflicts its own standards.

The reasons for these basic design errors on the part of designers is partly ignorance of the design criteria of their own standard structures and partly cost. When pressed, design firms will admit that, being profit-making organizations, they can only afford to do the same repetitive type of design unless other financial arrangements can be made.

With regard to the standardization of design and repetition of structures, the design consultants are not the only ones at fault, as a surprising number of government authorities (i.e. road, water and sewer authorities) in developing countries have no standard designs of their own, and if they do, are very reluctant to force their consultants (or even their own design engineers) to make use of them.⁽¹⁾ The reasons for this are numerous and some go to the very basis of the civil service system in these countries, but one is their continued dependence on outside designers and, especially in aid programme work, a feeling that as the financial agency is paying the designers the authority or ministry should not demand too much at a technical level.

There is an infamous water supply in West Africa that was originally built by the British and subsequently enlarged, first under a European country's aid programme and then by a North American. Not only did this one plant have three operating voltages but, it is understood, three different light bulb fittings. This of course gets into the field of tied aid, and the requirement of various aid programmes for the recipient country to purchase materials from the donor country regardless of previous historical patterns. This matter is, however, dealt with more fully in a later section of this paper.

The over-design, from an engineering, economic and social point of view on projects in developing countries also contributes greatly to increased cost. The position, advocated particularly by some administrators in the field of

(1) The use of "Modular Design" in the construction of low cost housing has been explored at great length in theory but is still little used in practices.

low cost housing and water supplies, that the problems in these areas are so chronic that it is impractical to provide facilities in the quantities necessary of as high a standard as one might wish, is fortunately gaining more and more acceptance in all fields of development. The proposal is not often popular at the political level, where the concept of second or even third best is sometimes unacceptable. This, however, is not directly a construction problem and will not be pursued in this paper except to note that construction costs could be greatly reduced if design standards, such as tolerances and finish, were reduced more in keeping with the practical and financial limitations of the country in which the structure is being built and the social requirements of the facilities. It is appreciated that it would be unpopular to advocate second class answers to pressing first class social problems, but given the limited financial and technical resources available it might be better to build two miles of bad road and face the resultant maintenance problems than one mile of good road and develop no immediate social advantage. One cause of this over-design, apart from the natural desire to go first class, is the use of high calibre international consultants designing elementary "low standard" structures which could be done by more junior design organizations.

From the point of view of construction problems not only are the structural/architectural designs in many cases over-designed, but the legal engineering requirement of the building specification (in many cases excerpts from, or complete copies of, standard developed country packages) are far too complex for the type of work carried out and in many cases for the level of education and technical competence to be found on the construction sites.

There are many examples of minor pipeline projects which have been burdened by Conditions of Contract, General Specifications, Detailed Specifications and pages of detailed drawings which would do justice to a multi-million dollar power station. Not only do such documents more or less demand more sophisticated contractors than are necessary for the job, but worse still are little read or understood by owner, Engineer or even contractor until some problem arises - and then they are often found to be deficient for the local situation encountered. One cannot help feeling that certain designers measure the results of their labours in "pounds of paper" produced and this attitude is catered to by their acceptance by aid agencies and augmenting authorities.

There are available many simple short technical specifications suitable for minor works and, if the recommendations contained later in this paper with regard to the contract administration of these smaller projects is adhered to, the requirements (if there ever were any) for these complex, legal-engineering documents would be reduced considerably. The introduction of standardized fittings, minor structures and construction procedures by the augmenting authorities would also reduce the necessity for design consultants to produce the large number of documents at present being used.

Not only the sheer size of construction specifications must come in for criticism but also their content. There is a tendency in developed countries, particularly Europe, to produce "end result type specifications" rather than "method type", and this prejudice against method type is carried over into design specifications for the development projects overseas. In an end-result type specification the designer specifies the result he requires (6,000 psi concrete, 90% compaction) and refers to some standard testing procedure, for example, "A.S.T.M." or "British Standard." In the method type, however, the actual method of producing the result is detailed (so many pounds of cement per cubic yard, so many passes with a specified roller etc.).

The "end result type" of requirement is preferred by designers because they claim it allows them to be sure of their end product and also that it does not discriminate against prospective contractors because they do not have the specified equipment. However, the lack of sophistication on the construction site prevalent in the majority of developing countries together with the lack of communication and qualified testing laboratories, makes the former reasoning doubtful and a judicial allowance for alternatives by the site construction staff would remove the latter objection. One tends to feel that the real reasoning behind the preference is the designer's natural reluctance to assume any of the construction risks and place all such risks with the contractor. The Owner however is paying for these risks and also the cost of an unsophisticated contractor in tackling the unknown.

At present the technical and legal specifications on smaller development-oriented projects are treated by the contractor as "a big stick" which can never be enforced for practical and political reasons and they tend to become a formal window dressing. The responsibility for obtaining the design requirements is therefore, by default, left to site management personnel.

Should the requirements suggested with regard to project construction management contained in this paper be augmented, more and more of the construction risks will both practically and legally be placed on the site supervisory staff where they more rightly should and the use of "method type specifications" would become more acceptable. Such procedures should not only reduce the design cost considerably (if only in paper used) but would reduce construction costs and time for the following reasons:

1. Smaller specialized local contractors would be able to compete with the larger, often more expensive, organization - (See Section 3 for a further discussion of this problem).
2. Standardized and/or repetitive structures would promote pre-fabrication of elements as well as the inherent savings due to repetitive work.

3. Many (particular smaller) contractors are intimidated by the sheer size of the paper work and increase their prices to cover the unknowns caused by something in the specification they do not understand.

The problem discussed above with regard to design of smaller development projects has been recognized in a superficial sort of way by various development agencies. They have been clothed in such words as "local conditions" and "indigenous construction environment". The traditional method of trying to negate their effect has been the use of local associates by expatriate design consultants. Some development agencies have made such association mandatory while many others merely recommend it. A secondary advantage (or maybe the primary reason) is that such associations may help to train local consultants in the field of design - the missionary syndrome of foreign aid coming to the fore again.

With a few notable exceptions, these associations have been failures. In many cases the local consultants are as guilty of as many of the design faults discussed above as their expatriate partners. Many of these local designers have less site experience than for example, North American designers, and their training, even at local technical institutes, is western-oriented and their ambition is often to emulate their expatriate counter-parts, warts and all. At best these local associated companies become a glorified drafting service and at worst, merely a representative to arrange site transport and look after the local necessities such as graft. Arguments put forward against such associations by the prime consultants, who are normally expatriate, are that their financial arrangements do not allow them the time to engage in any educational process and that the expertise available at the technical level from these associates is so limited and communication so slow, there is little advantage to them in such arrangements. The associated local engineers, on the other hand, complain that such arrangements take up a lot of their time without their obtaining very much technical involvement or financial reward. Many of them suggest that a more realistic arrangement would be for the local organization to be the prime consultant, using expatriate expertise if and when considered necessary, and this has been tried in some cases with encouraging results.

This latter idea would provide more of an "education" for local engineering industries; it would however, conflict with the "donor country-content" requirements of certain aid organizations.

Much has been written about the use of local materials in construction, particularly in the field of housing, however not so much has been done in the field of civil engineering construction. Perhaps in this case the architects are ahead of the engineers, the latter bound by their traditional conservatism and unfortunately by their training. Some work has been done

by organizations such as the United Nations in the use of soil cements and bamboo in civil construction (1) and by the Intermediate Technology Development Group of London; (2) however, in the design office lip service appears to be all that is paid to the idea of using local or traditional crafts and materials. As with labour-intensive work (which is discussed in detail in another section of this paper) part of the problem is the unwillingness on the part of the indigenous people (in this case engineers, civil servants and policy makers, as the actual craftsmen are seldom asked their views) to move, as they consider, backwards. Another reason is the reluctance on the part of design engineers to experiment with processes or materials that have not been tried and proved in developed countries. Yet it is possible to substitute soil cement for asphalt stabilized roads where cement is a local product and oil is not, and to substitute hand placed masonry retaining walls for reinforced concrete where both the cement and reinforcing steel have to be imported.

In designing projects that are to be constructed using labour-intensive methods a completely new approach must be taken by the designer. The traditional concepts with, for example road alignment, compaction etc., have to be re-evaluated. Some research type work is being done in this field, particularly by the International Labour Office (3) and the Bureau of Public Highways in the Philippines, (4) however, the mechanics of the necessary design changes are relatively straightforward - it is the turn-around in concept and priority that is difficult to implement. As far as this paper is concerned it is only pointed out that projects that are to be constructed by labour intensive methods must be so identified at the design stage (or even earlier at the preliminary concept stage) and designed accordingly. Some of the conflicting results being obtained by the people at present working on the economics of labour-intensive construction may be due to the projects being studied being originally conceived and designed for equipment-intensive operation, or if not actively designed for such operations, being designed in the traditional manner which, because of the training and technical bias of the engineers,

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- (1) "The Use of Bamboo & Reeds in Building Construction" U.N. Pub. ST/SOA/113
"Soil Cement its use in Building" U.N. Pub. ST/SOA/54
 - (2) "Cements Little Brother Shows Indian Promise" New Civil Engineer 7 March '74
A Design for a Medium Span Wooden Bridge in Kenya" Intermediate Technology Vol. 1 #4.
 - (3) The Role of Design in the Choice of Road Construction Techniques
G.A. Edmonds, I.L.O. Geneva 1975.
 - (4) Manual of Construction of Roads by Labour-Intensive Methods - Bureau of Public Highways Manila - (unpublished).

produces results which favour the traditional capital-intensive construction methods. In other words, it is unlikely that economic labour-intensive operations will be obtained on a project designed in the traditional manner any more than economical equipment operation could be obtained on a project designed for labour-intensive construction. Other aspects of labour-intensive construction and in particular its management are discussed at length elsewhere in this paper.

In order to overcome some of the construction problems due to inappropriate design which are now being encountered, the following is proposed:

- a. Augmenting authorities (Ministries, Authorities, etc.,) and overseas development agencies should be more selective in the organizations they hire or approve to design projects in developing countries. Particularly small projects in which local rather than international resources are to be used. Not only should the firm have had experience in the particular specialty and country involved, but the individual design engineers and technicians should also have had this experience.
- b. Where local engineering capacity exists in the developing country (even if this is only in the form of expatriate companies) these should be given responsibility for detail design, with access to specialized expertise in other countries if necessary.
- c. Every effort should be made by operating authorities in developing countries to standardize their designs and documentation and to ensure such standards are adhered to by their own designers, their own design consultants, and those working for them through financial agencies. Where they do not have such standards, it would be a beneficial development project, worthy of international financing, to produce them and carry out the necessary administration for them to be used. (Due to the "continuing emergency" type of management practised by most of these organizations, it is the administration of policy directives, rather than policy itself, that gets lost in day-to-day operations).
- d. All development projects should be subject to a detailed post-mortem at some time shortly after the facility is completed (preferably after some operating experience has been gained). To such a report, not only the designers (in person rather than a representative of the company) but also the construction site staff, contractors and operating personnel should contribute. The object of this, amongst other things, would be to gain an insight into the construction and operational problems inherent in the original design. The cost of such meetings it is felt should be borne by the designers, as it is they that are gaining the experience. However, when this is suggested they decline mainly from financial considerations. It may be advantageous for development aid agencies to finance such reports on projects which they finance. Considering the magnitude of "pre-construction", studies, visits, reports etc., that are at present carried out, an additional one after construction may be in order.

- e. Finally there must be a trend to simplify design, drawings, specifications and the complexity of these projects. The mountains of paper that these construction projects now generate must be reduced. Guidelines in this direction should be published by international development agencies and their design consultants be made to conform. Fifty years ago simple infrastructure projects of this type were undertaken with little more than a sketch, a one page contract and a lot of good will. The construction industry, even in developing countries considers itself to have "progressed" beyond this and it would be hard to return, however it is something for which to aim.

ADMINISTRATION PROCEDURES & THE BUREAUCRACIES INVOLVED

As with any construction project, overseas construction projects can be, and have been, administered in a variety of ways with various degrees of success - the decision as to the method of augmentation is often made on the basis of political expedience or preconceived industrial dogmas rather than any rational evaluation of the most efficient and least time-consuming methods of carrying them out. In order to carry out an evaluation of the most effective administration techniques, it is necessary to consider the available alternatives, the necessary bureaucratic and institutional organizations with which the project will be involved and the existing or imported expertise within these bureaucracies and within the construction industry.

It is indeed difficult to generalize all these factors for all developing countries and various considerations will predominate in any particular case, however studies of the administrative problems in widely different situations have provided a remarkable consensus as to these problems and to proposed methods of overcoming them.

The most widely used method of construction administration on development projects is the traditional (in Western developed countries) tender-contract method, where open or prequalified lists of contracting individuals or companies tender on large sections of the work. The lowest (or in some cases the most reasonable, based on complex evaluation systems) is awarded the work and from then on it is its responsibility to complete the work with only policing duties (in theory) being carried out by the augmenting authority or its agents - the Engineer. Variations on this method of administration are when certain materials are supplied by the owner or when certain specialized sub-contractors are specified or nominated by him, but basically the responsibility for the day-to-day running of the job and for getting the work done and conforming to the letter and intent of the drawings and specification is left to the contractor with, as stated, the owner or his designated consultant having only policing powers though these may vary in detail from contract to contract.

This method of construction is well entrenched in the western developed world where a highly developed construction industry exists, where a tradition of contract responsibility is inherent and where design criteria, construction methods and material procurement procedures are standardized and institutionalized. It also undoubtedly has its place in the construction of vast development projects in less developed countries where international construction companies, international consultants and an independent augmenting authority are operating - though even on these there is a case to consider the modifications discussed below. It is doubtful, however, whether this method of construction administration is applicable, or even in some cases workable, in the majority of smaller infrastructure type construction projects being considered in this paper. Not only are the contractors involved in such works in many cases unable or unwilling to devote the necessary managerial, financial and technical resources to produce

an economical construction package but the bureaucracy involved in the owner's organization puts every frustration in the way of even the most dedicated contractor. There is, however, a dogma of the construction industry that this traditional method of tendering and construction management is the most economical. This dogma is now being questioned more and more in developed countries but is still well entrenched in many of the developing countries and particularly in international financial agencies.

Apart from the administration problems involved in the tender/contractor method of augmentation, it is the basic adversity arrangement that comes into being once a contract is signed that causes the problems. The contractor, who is held to sometimes unrealistic tender prices, attempts to do the work as economically as he is capable, often by the use of excessive delays and takes every opportunity to obtain additional revenue in the way of claims, extra work, etc., while the owner on the other hand attempts to force the contractor to perform his contract and is at best unsympathetic to his problems, frustrations and difficulties, many of them the fault of the owner himself. The other deficiency of this system, due to the inherent bureaucratic problems of the owner, will be discussed at length subsequently.

Modifications of this basic tender-contract system are gaining popularity for larger public works and development type construction projects in North America. These are all geared to reduce the conflicts that are inherent in the traditional system and spread the construction risks more evenly between the owner and the contractor. The most popular and successful of these are the "target estimate contracts" in which the contractor works on a 'cost-plus' basis up to a total estimated cost (based on a complex system of lump sums and unit prices) and then participates with the owner on some percentage basis on any cost overruns or savings on this figure. Other modifications, with incentives of various types, are also gaining popularity particularly in the private development field. In all these systems, however, the prime contractor retains control of the work including sub-contractors and is responsible for the day-to-day management of the project. In these modifications the role of the owner's representative (or Engineer) becomes more complex and sophisticated than merely policing the contract and it requires a high calibre of management expertise on all sides.

The use of these modifications in the construction of small overseas development projects is not recommended because of the inherent political difficulties of implementing any incentive or bonus system and, more important, the lack of management expertise on the part of the majority of contractors involved and the ability of the existing civil service bureaucracy to handle such contract arrangements.

The next major method of carrying out construction work, particularly infrastructure projects, repairs and other smaller projects is by direct labour (sometimes called force account). In this method the augmenting agency (or owner) obtains the materials, owns or leases the equipment and hires the labour directly. The actual methods of payment for such equipment and labour can vary from day wages to forms of piece-work or even larger scale "labour only" type contracts. This type of organization has been used for many years in some countries and where there is no construction industry as such, it is the only method of construction that is known. In these countries the system is highly institutionalized and efficient, particularly in any labour-intensive operation. (1)

Direct labour work has, however, obtained unfortunate connotations of inefficiency and backwardness, particularly with international financial agencies. Though undoubtedly such an arrangement does lend itself to abuse, so does any contract system and like such system is only as efficient as its administration. Certain lending agencies will only grant funds to be spent in this way under emergency conditions.

There appears to be no conclusive evidence, however, that direct labour construction methods are necessarily inefficient, in fact there are certain studies showing that it is at least no more costly.(2) It is, of course, always difficult to make true cost comparisons in such matters because direct labour work tends to be fragmented and also because many overhead costs are lost in the established costs of the augmenting agency or are hidden under engineering costs.

Two interesting examples of overseas development work being carried out by systems of modified direct labour are worthy of comment: The first is the construction and reconstruction of sections of seawall protection in South America. Originally this project was bid by international tendering, the prices, however, were higher than anticipated and it was decided to do the work by a system of project management and modified direct labour. Apart from delays due to late procurement of equipment and materials (which doubtless would have involved claims for additional costs had the job been awarded to a prime contractor) the job has progressed satisfactorily and it appears will be completed at a cost below the lowest tender price. This job was, however, of a high risk nature, which may have caused the initial high tender prices - this is not the case in the next example.

(1) The "Paquio" system used in the Philippines and the "Schedule - of - Work" system in Jamaica.

(2) A Cost Comparison Study of Force Account and Contract Construction On Five Secondary Road Projects in North Carolina" Farrell & Kilpatrick. Dept. of Commerce Bureau of Public Roads, Washington, D.C. 1956

The second project of interest is a low-cost housing project financed by the United Nations in various countries of Central America. In this project the same basic design of low cost houses was built in various areas of three South American countries, some by contractors, and some by direct labour methods. Though further study would be necessary in order to ascertain the exact differences in the situation between various sites, from the figures immediately available it appears that, though there is some increase in material costs that is unexplained, the labour content of doing the work by direct supervised methods is no higher than where a contractor was employed.

The lesson to be learned from these, and other examples of projects constructed without a prime contractor, is not so much that the system of management is less costly, but it appears to be no more so, and the system has many added advantages from an administrative point of view.

The most obvious advantage of the direct labour system of construction is the reduced time that implementation can start. Drawings and contract documents do not have to be prepared to the extent necessary for prime contracts and the tendering and sometimes excessive appraisal and award period is avoided. This in itself can contribute substantial cost savings. Another advantage is that the day-to-day site control is in the hands of the owner or his direct representative who can make allowances for such circumstances as late delivery of materials, unforeseen construction conditions and changes in design with a minimum of disruption to the overall programme - something a prime contractor may not be able to do for lack of information, financial considerations, lack of management foresight or in some cases a wish to put the owner "on the block."

Some less obvious advantages are also accrued to the owner by this system of construction. The most interesting is the educational experience gained by the staff of the augmenting agency (particularly its technical designers and administrators) in having to carry out the day-to-day field management of the project. It is recognized that agencies that carry out any large part of these operations in this manner produce more realistic designs and have a greater facility for accurate cost estimating than ones that leave this work to others.(1) Other advantages are the ability of the agency to augment directly such political policy decisions as labour-intensive work and local preference without having to do so by means of contract requirements which are hard to administer and are sometimes overruled by financial expediency.

The major problem with this system of management is the shortage of qualified technical administrators available to the augmenting agency and the ability of their existing overburdened bureaucracy to handle it. These shortages are discussed in the later part of this section and some

(1) See the comments on this matter contained in Section 7.

recommendations put forward, however, it has been the author's experience that the government and semi-government agencies with which he has been associated have within their staff or available to them much untapped talent in this regard who are made unavailable through mismanagement of their personnel.

The largest deterrent to the use of direct labour in this type of construction is the inbred prejudice against it mainly by the construction industry, (this prejudice is understandable as it is a blow to their livelihood) and by the international lending organizations who still cling to the concept that competitive tendering will automatically produce a minimum total cost package. This has not been demonstrated to the author's satisfaction.

The last method of construction considered is that of self-help or volunteer labour. It is only considered in order to keep this section complete and because it is a concept much discussed in the literature and beloved of philosophic writers on the subject of development aid. It is not considered a realistic method of carrying out the majority of development projects.

With the exception of self-help housing projects, where the worker is producing a tangible product for himself and not for the community, the author's experience, and that of many others who have had experience in this field, is that such projects are beset with untold administrative problems and avoidable delays. The same work would be more efficiently carried out by some method of subsidized labour (if necessary in the form of food) or work brigades. Particularly if expensive equipment is involved, these projects become exceptionally extensive and administratively complex.

There are of course many reports of community water supplies, rural roads or schools being successfully completed using such "barn-raising" techniques, however, they only appear to be successful in those countries where there is an inborn community spirit, an authoritarian form of local government or a very strong personality involved. These projects may be successful the first time, but once the novelty wears off, the work goes on without money and/or food coming in, the enthusiasm flags, attendance drops and in many cases the job must be completed by conventional methods.

As stated before, one field where self-help appears to be successful, though an administrative nightmare, is in housing. It is felt that this is because strict screening processes are usually involved and because the workers are building something that will revert to them personally and hence increase their personal wealth or status. The author's experience in this field, has admittedly been in countries where the native population is individualistic rather than community oriented and these opinions

may, therefore, be prejudiced.

No matter what system of construction administration is used, be it a conventional prime-contract or its modifications, direct labour or self-help, there are three ways in which the supervision of the work (what might be called the field or administrative engineering) is carried out. The first, and in most development projects of any size the most common, is for the augmenting authority to appoint a consulting engineer, (normally but not always the designer of the project) as representative of the owner, to administer and control the construction phase. In the case of formal construction contracts he is appointed the Engineer under the contract and has legal duties and responsibilities as such. In the case of direct labour and self-help projects he becomes agent for the owner and acts on his behalf under a variety of legal and financial arrangements between him and the owner.

The second method is for the owner or the augmenting authority to carry out his own supervision either with his own in-house staff or by setting up a separate organizational department for this purpose. In many developing countries the latter would be preferred but due to shortages of manpower and financial resources, the first method has to be employed.

The major objection to the traditional design/construct supervision method is that the design consultants (particularly smaller companies) do not always have on their staff experienced construction engineers and also, having designed the facility they tend to be prejudiced in the adjudication of the contractor's complaints with regard to design and administration problems. It has also been pointed out that construction supervision is not as financially remunerative to design engineering companies as design work, with the result that these companies do not devote full resources to such activities.

The third administrative system, which is gaining popularity in North America and elsewhere, is the use of specialized construction management personnel or teams who have extensive experience in the field of construction management, but normally do not themselves become engaged in design or construction. In some cases these organizations take over responsibility for the management of both the design and construction phases, where the arrangement is called "project management" and in other cases they have the responsibility for the construction phase only and is called "construction management". The mechanics of these methods of construction are well documented, (1) however, they prove themselves particularly useful where the contracts are small and numerous or where the system of direct labour as discussed earlier are involved. One reason that this type of administrative system has not been used in overseas development work is the lack of firms specializing in development construction management in developing countries,

(1) "Construction Management Contracts" & "Project Management Contracts"
- Canadian Construction Association, Ottawa.

the reluctance on the part of overseas governments to change from traditional design/construct arrangements and their feeling that they would be losing control of expenditure unless a duplication of supervisory staff is provided.

The compromise recommendations contained herein, it is hoped will overcome some of the disadvantages of these various systems, but before putting them forward it is necessary to look closely at the two organizations with which any supervisor would have to deal - the existing contracting industry and the civil service bureaucracy within the augmenting agency.

The construction industry in developing countries has been the subject of many studies,⁽¹⁾ and it varies in size and sophistication from countries such as Korea and the Philippines where local construction companies are capable of bidding on international tenders down to some countries where the local contractors are no more than tradesmen/house builders. With such disparity it is hard to generalize, however the following observations appear valid in the majority of cases.

Though in some countries there is undoubtedly a shortage of technical personnel and skilled craftsmen, it is at a sub-professional and foreman level that the greatest shortage in manpower exists. This is due to overspecialization and overtraining of professional engineers, immigration to the metropolitan countries of the more aggressive tradesmen, a social bias against the construction industry except as an entrepreneur and a shortage of formal or on-site training facilities for these lower levels of supervision. Personal observation of specific construction operations in the West Indies (block laying, pipe laying etc.) has shown that the actual production of craftsmen over short periods is not much below North American standards, however over longer periods the production falls off rapidly due to supervisory breakdowns (running out of materials), poor scheduling, and inefficient planning - all the duty primarily of the foreman and the supervisory staff rather than the craftsman himself.

The number of local contractors, particularly of a small size, is far greater than the economy or market can bear. The majority of these are of necessity part-time contractors, sometimes waiting months or even years between jobs. They are under-financed, under-equipped and though in many cases technically competent, fall easily victim to cash flow and other administrative problems.

(1) "Promotion of Construction Industry in Developing Countries" de Wilde & Assoc. I.B.R.D. Washington, D.C. 1974

Though there are many examples of expatriate construction companies competing successfully with local organizations, it is more in the field of specialized sub-trades and large-scale projects requiring a high financial content that such companies specialize. In small infrastructure type work, they normally cannot compete for want of local knowledge, high overhead costs and, more important, access to the "grapevine", through which labour, material, and political problems are often avoided,

Profit margin by contractors in developing countries is much higher than would be expected in North America (admitted figures of 30% are not uncommon against an equivalent of 10-15%). Expatriate contractors have always expected profits of this magnitude on overseas work and local contractors may tend to copy this lead, however the overabundance of contractors in the majority of countries and a low volume of work make high mark-up a necessity to pay for often idle equipment and continuing overheads. It is also true that estimating techniques by all but a very few of these contractors are little more than guesses, sometimes being made by professional estimators not acquainted with the contractors, and the high profit mark-up is necessary to cover errors and ignorance in these estimates.

The award of contracts is often more of a lottery than the result of true competitive tendering, and is considered as such by the contractors; contracts are awarded, if not to political contributors at least to the contractor who made most errors in his tender. The result is that contractors often consider that the award is merely a 'foot-in-the-door' and a convenient place from which to negotiate satisfactory prices which would not embarrass the owner but would give the contractor a satisfactory profit. Claims and extras are negotiated for on the same basis as oranges in a market and any attempts to rationalize such payments are considered most unfair practice. Despite protestations of innocence and attempts by outside organization to require pre-tender qualifications, engineers independent estimates, and other window dressing the system appears to persist and is accepted at a practical if not an official level.

The more experienced and better qualified contractors in many countries, knowing of these problems and those discussed hereafter, tend to avoid possible involvement in development work particularly rural development, concentrating more on the private sector and leave the public development in the hands of the more politically oriented and sometimes less qualified organizations.

Having discussed the condition of much of the construction industry in developing countries, the bureaucracies with which they have to involve themselves will be considered.

Civil services are overcrowded and inefficient in most countries but in many underdeveloped countries this has become an art-form that is sometimes unbelievable. Any system which is designed to produce timely and economical results must bypass as much as possible of the inefficiency inherent in these organizations.

It is not the purpose of this paper to investigate the reasons for this phenomenon but to point out that this represents one of the main sources of delay and overrun in the cost of project implementation. Nor is it the purpose of this paper to suggest methods of reducing such bottlenecks, if such were possible. A school of thought, not without merit, is that such bureaucracies are necessary to alleviate the chronic unemployment amongst the overeducated high school graduates that many of these countries produce.

To the construction manager, whose primary task is the augmentation of a project, it is necessary to devise systems whereby the holdup and additional cost inherent in such conditions can be minimized. The areas in which delays (and hence cost overruns) occur are as follows:

1. Pre-construction decision making
2. Awards of contracts
3. Day-to-day construction administration
4. Finalization of payments
5. Material and equipment acquisition

Each of these will be considered separately:

1. With regard to pre-construction decision making it is not only the local bureaucracy but also that of the international lending agencies that cause delays and additional costs. On one project, financed by such an institution, the author was aware of at least three conducted tours of the proposed site arranged for the officials of the organization because of the appointment of new "project officers", new consulting teams, etc. (It is interesting to note that during the construction phase of the project so little interest was shown that no such tours were organized). Such financial organizations, as well as local ministries, frequently require detailed questionnaires, organizational rearrangements and other preconditions of release of money that are often outside the technical and manpower resources of the augmenting agencies.

These problems, it is admitted, are outside the scope of construction, however the proposed solutions to the points 2-5 below would also alleviate to a great extent the delays caused in this early stage of the project.

2. Delays of up to six months between tenders being received and the award of the contracts on relatively minor development projects have been experienced. Such time is taken up on tender reviews, evaluation reports to contract sub-committees, ministries reports and a host of other formalities. Though it is appreciated that some tender evaluation is very necessary, this time-consuming operation could be reduced. In many cases the tenders run out and have to be renegotiated, and experienced contractors knowing of such delays in award in advance tend to either avoid such work or increase their tenders accordingly.

3. Construction is a rapidly moving activity and not suited to set rules, regulations and procedures - problems have to be solved and decisions made at a field level, and except in some technical matters, the majority of the problems is of a straightforward and administrative nature requiring inventiveness and resourcefulness rather than technical competence. This is true not only on the part of the contractor but also the engineer and the owner with whom he is working. It requires a particular individualistic type of person and necessitates financial trust and responsibility to be placed at a relatively low level in the staff structure. Successful constructional organizations, be they contractors, engineers or construction branches of operating agencies, have realized and attracted such people in all countries. Such people however, are seldom found in formal civil service structures which are more geared to regulatory and operational problems rather than the entrepreneurial requirements of construction. Such civil service organizations therefore tend to look at each claim as a financial disaster and at each petty day-to-day decision as worthy of numerous reports, recommendations and further procrastination.

Although some service departments of governments (public works departments, water authorities, etc.) are notoriously good in the field of contract administration, the ministries to which they are responsible and who maintain strict financial control over them, are often burdened with the full horror of bureaucratic delay and lack of administrative decision making.

4. To organizations who are sometimes many years behind in their annual financial statements, finalizing a construction contract, particularly one encumbered with such problems as delays, extensions of time and claims for additional work, becomes a major undertaking and the response is often to put off the evil hour. The resultant delay in settlement to contractors causes additional costs, if not in that project at least on the next tender. Again it is a lack of decision making authority at an executive administrative level that is responsible rather than the lack of finances or manpower that is often claimed.

5. The problems associated with the acquisition of materials and equipment are probably the biggest and most prevalent reasons for cost and time overruns in development projects overseas. For good reason the responsibility for such acquisition often rests with the augmenting government agency rather than the contractor and because of this, is inflicted with the administrative delays inherent in such an organization. The problem is so basic to any discussion of cost and time that a whole section of this paper will be devoted to it. Suffice to say that the

proposal set forth will, if not solve this recurring problem, reduce the immense delays and cost overruns at present being caused by this facet of the construction organization.

Having considered the possible management techniques available and the problems associated with the construction industry and the bureaucracies with which they are involved, it is possible to recommend a procedure which should minimize these costly problems and provide a vehicle to augment projects more economically.

The first requirement of the system is that the authority for day-to-day construction decisions both technical, financial and administrative be placed at a level where these can be made quickly, and such persons should be unencumbered by other bureaucratic responsibilities. Such a person and his staff should have the technical competence to carry out the necessary scheduling, ordering, and other augmenting duties necessary to ensure smooth construction activity and make alternative arrangements without recourse to higher authority except for major financial, political or technical commitments. Finally such an organization must only be set up for the duration of the project and "self destruct" on its successful completion.

It is suggested that the construction of overseas infrastructure development projects be constructed under a form of project management using a modified system of direct labour.

A project manager should be a high calibre construction engineer, preferably responsible directly to the augmenting agency but also in direct communication with the financial institution involved. This person could in many cases be seconded from the civil service of the country involved, could be from a private organization or hired directly by the augmenting or financial agency. There are available in many countries competent people of this calibre within and outside government organizations and the necessity to use expatriates should not arise in most cases.

The project manager should report to the augmenting agency only at the highest level and all decisions affecting the construction management should be his alone. Whether he should also be responsible for the design stage is doubtful but may be considered. He should, however, be responsible for all material and equipment acquisition using existing government facilities only if it is considered expedient. On larger projects the necessary staff would have to be provided, however this staff should be kept to a minimum, as experience is that the quality of such administration decreases with its size and its eventual liquidation becomes more of a problem. In some cases the organization can be responsible for more than one project, however this should only be done if no additional staff will be required.

The possibility of this management team being responsible to the financial organization directly has been considered, but much as this has administrative advantages, it is considered politically impractical. The recommended procedure would be for the personnel of this organization to be seconded from the local government or its agencies or recruited on contract for the project only. Another possibility would be to obtain the services of an experienced contractor on a fee basis.

The project manager would have financial control of expenditures within strict limits set by the augmenting agency or the financial lending institution and within these limits carry out all the work, by contract, by direct labour, or a combination of these so as to suit the changing conditions imposed upon him. Contracts would not be of a "prime" nature but only for specialized type of work or smaller piece-work. Equipment would be bought or rented directly by the manager and material ordering and expediting his responsibility. Most important, the day-to-day scheduling and site organization would be in his hands rather than in those of a variety of contracting organizations.

The relationship between the construction organization and the design engineers will be such that the designers will be "design consultants" being consulted on any technical matter or design changes and being paid on a time basis. Their involvement in the construction administration would thus be limited.

The involvement of an augmenting agency would also be reduced except at the highest financial and technical level. There would however have to be certain consultations on operational and administrative problems at lower levels, and use could be made of their service organizations if this was considered by the project manager to be expedient.

In order to avoid this construction team growing into its own civil-service empire, as has happened with such organizations in the past, it is necessary that it be dissolved at the successful completion of the construction project for which it was organized. Failure of such a closure will only ultimately lead to all the frustrations and inefficiencies that such an organization was meant to avoid.

Further details of the make-up of this proposed organization are contained in the appendix to this paper.

Administrative systems such as described above have been used in various overseas development projects previously and some have been particularly successful, (1) however if anything can be learnt from them, the failure to fully reach their potential can be attributed to one of the following reasons:

1. Too tight a control of the organization by the responsible agency or ministry, resulting in the bureaucratic indecisions discussed previously.
2. The organization growing in size and complexity so as to become its own bureaucratic problem area.
3. Senior personnel within the organization (usually civil service secondments) unwilling to make the necessary decisions and take the responsibility for such decisions.
4. Additional responsibilities being foisted onto the organization (with or without additional staff) until the project manager becomes the manager of an organization rather than of a construction project.
5. Letting prime contracts in the traditional manner so that the project manager becomes no more than a policeman (or the traditional Resident Engineer) and the advantages he has of day-to-day organization of the project are lost.

It is appreciated that the organizational method of construction proposed will be unpopular to nearly all those involved. The contractors will not like the responsibility, and hence the profit involved, in day-to-day construction managing being taken from them. The augmenting agencies will not like the control of funds and the resultant status being wielded by someone or some organization outside their normal chain of command. The financial lending institutions will not like to involve themselves in the augmenting of projects, a field that they have hitherto avoided. The local politicians will consider the involvement of the financial agency as an infringement on their sovereignty and even the seconded civil servant, no matter how well qualified, may not relish the position of project manager, as he may consider it taking him out of the civil-service mainstream.

However, the people who should be pleased and to whom such an organization would be of benefit are the people for whom the facility is being built, as such a organization will produce the facility in a shorter time and at a lesser cost than the traditional methods.

(1) Sites & Services Project - Jamaica Ministry of Housing financed by I.B.R.D.

THE MATERIALS PROBLEM

In any discussion with people involved with the construction of overseas projects the one problem that appears to be universal is that of materials and equipment delivery. In many instances it is quoted as the only real cause of delays and construction overruns. Where the problem is solved (by ordering twice as much as necessary twice as early) the additional cost is borne by the project. There are unlimited examples of material and equipment being delayed, misshipped or lost on wharves, of equipment idle for years for lack of parts or of factories or treatment plants held up for months because of short-shipment (or loss) of vital equipment.

The problems appear to be three-fold:-

1. Delays and confusion in the ordering of materials and equipment
2. Shipping and expediting problems
3. Import restriction and articles "lost on wharf".

It is a common practice on overseas development projects for the augmenting agency to buy the necessary material and equipment well ahead of actual construction and supply this to the contractor. The reasons for this are valid and considering the long lead time usually required, justified. Some of the agencies however, do not order their material or equipment directly, but through some central government purchasing agency. These agencies have been set up on the assumption that they could, by bulk purchasing, get better prices and by taking purchasing decisions away from individual civil servants reduce the possibility of graft. Both are admirable reasons but because of the delays, errors and inefficiencies that appear to be the standard of nearly all of these agencies it is doubtful whether any money is saved.

The majority of materials and equipment required on development projects is specialized or even 'one-of-a-kind' and little or no advantage can be obtained from bulk buying programmes, and where bulk purchases may be advantageous, (for asphalt, pipes, cement etc.) stock piles of material are usually kept on hand. As for the reduction of graft it is doubtful whether the savings are worth the time lost by using them or whether the employees of the purchasing agency are any more resistant than others.

One result of the purchasing agency problem is delays up to six months in placing orders, another is errors in orders due to the non-technical placing of these orders and yet another is incompatibility of equipment due to these agencies calling for tenders on equipment and awarding them on the basis of price rather than technical specification.

When materials for projects have to be purchased through an Aid agency, as in many tied-aid arrangements, problems also exist. It is not the intention of this paper to discuss the merits of tied-aid of this type, but only to point out some of the technical problems that have been experienced because of this arrangement. The most obvious and serious problem is that of incompatibility - the case of the many-bulbed treatment plant is a good example. Another recurrent problem is the supply of equipment by a donor country for which spares are not available locally, for which there is no local agent or which requires a high level of technical expertise not available in the recipient country.

It should also be pointed out that the purchasing and expediting facilities in donor countries offered by certain aid agencies are no better than those to be found in undeveloped countries, having within them not only the same delays due to bureaucratic procrastination but also the added confusion of long and unreliable lines of communication.

The problem with respect to shipping and expediting is largely one of personnel. The job of material expediting (like that of store-keeping) is too important to be left to the minor clerk and other personnel considered unfit for other duties, yet it is precisely this type of person who fills these jobs both in underdeveloped and developed countries. Material and equipment expediting is an exacting, full-time position requiring high calibre people with both experience and a dedication to a frustrating and often thankless job. The expeditor must keep in constant contact with all the cargo for which he is responsible, arrange necessary or alternative methods of transport and also keep the project management informed of realistic delivery dates and possible delays. As well as this he must be able within his technical competence, to spot missing or incorrect shipments, incompatibilities and other potential problems prior to the arrival of the material. All too often this exacting task is given to some retainer, working out his pension, or to a junior clerk who can do little more than match up order numbers. In many cases these cargo expeditors are responsible, not to the augmenting agency but to some other administrative branches of government causing further communication and management problems. One result of the above is that many material problems that could have been solved or at least mitigated are not known of until too late and costly delays result. Another related problem is that project management spends a disproportionate amount of its time carrying out these functions rather than their prime job of running the on-site construction activity.

Recently the author carried out a time study on himself while managing a development construction project and, found that 30 percent of his active (non-travelling) time was spent on material and equipment expediting activities. (Closely following, it may be added, by about 20 percent of his time looking and waiting for files).

It must also be appreciated that, except where political pressures are brought to bear in the metropolitan countries on fabricators or exporters, small-scale orders to developing countries often have low priority for such companies. This often accounts for the apparent excessive delivery times quoted, and the many extensions of such delivery times subsequently imposed. It is felt that little can be done to mitigate this at the project level, however, financing agencies should take it into account when involving themselves in the expediting and shipping of such materials.

Closely related to the problem of expediting and shipping materials is that of the clearing of materials off the wharf, through the necessary customs etc., and getting them to the site. How often have materials arrived only to be lost on the wharf or held up because of customs clearance? It is told that the situation in one African country gets so bad that every so often all material still on the wharf is bulldozed into the sea to make way for more cargo. This may or may not be true, but to anyone having experienced the confusion, red-tape and incompetence prevalent at the wharves in some developing countries it is not inconceivable. The amazing situation however, is that government goods (for which there is no duty or customs to be paid) fare no better. There are many instances where the payment involved has been relatively small, that it has been found faster to clear materials or equipment as private goods and pay the necessary duty than to wait for the government process to obtain the articles duty-free.

In many cases the problem here again is one of personnel, as the job of finding materials on the wharf and clearing them through the necessary formalities is often given to someone who has not the technical ability nor the personal drive for such an exacting and demanding task. It is not within the scope of this paper to try to suggest methods of clearing up the mess on dock areas in the many countries receiving overseas aid, in fact it is doubtful whether any realistic solutions can be found, however, it is felt that if costs and time are to be reduced on the implementation of development projects some method of bypassing or accelerating these procedures must be found.

It appears universal that the wharf is a principal area of graft and that without its use of such "black-money" it is just about impossible to liberate materials. Private companies operating in developing countries find early that in order to survive they must provide a short-circuit to this system, and they either hire themselves competent dynamic and productive personnel to do their cargo clearance and expediting duties or more commonly hire private custom brokerage houses to do these for a sometimes exorbitantly high fee, presumably including the necessary graft.

It is suggested that the most expedient way to try and bypass these major bottlenecks is for the responsibility for these duties (purchasing and expediting) to be placed with the project manager as suggested previously in section 4 and to hire the necessary highly qualified (and highly paid) personnel for this purpose. This person could also be responsible for wharf clearance and finding cargo, however, it is suggested that these latter duties would better be carried out by a well-established local firm of custom brokers.

Once the responsibility for the material and acquisition duties has been placed in this one location such refinements as local preference, donor country content and the like can be controlled and supervised by other agencies but the actual ordering, expediting and handling carried out by this independent organization. An added advantage of placing these responsibilities with the project manager would be his ability to use first-hand knowledge of the materials and equipment situation in the scheduling of the site work itself.

It is appreciated that such an arrangement would not be popular with the government purchasing organizations whether they be in the donor or recipient country, however, if a realistic attempt is to be made to reduce construction time and cost, these inefficient organizations must be bypassed. The relatively small savings that may be obtained by using these larger organizations are more than compensated for by the savings in delay that have been obtained where the independent procurement procedures have been used successfully.

MANPOWER AND MACHINE POWER MANAGEMENT

One facet of the construction of overseas development projects that has received considerable resurgence of notice recently is the use of labour-intensive methods - particularly for earthworks such as road building, canals, etc. Much study (1) has been done particularly by the International Bank for Reconstruction and Development, the International Labour Office, and the Intermediate Technology Group and much on-site work is being done in this area particularly in India, Indonesia and in the Philippines. The work in India (particularly the use of the Land Army) (2) and in the Philippines (3) (Work Brigades) are worthy of further study.

The majority of research has been done into the economic viability of such construction methods but also to a lesser extent into the use of labour-intensive tools, materials and other facets of the problem. In the Land Army, the work in Indonesia and particularly the work of the Bureau of Public Highways in the Philippines the problem of the administration of this work is also being closely examined.

Though there are certain conflicts in the conclusions reached in the various reports on this subject, from an economic point of view the consensus appears that, under certain circumstances certain parts of projects can be constructed competitively by labour-intensive methods. The actual level and extent of labour-intensive activity is dependent on local cost comparisons, ground conditions and, as pointed out in section 2 of this paper, the design. Much use is made in these analyses of "shadow" or "social pricing" concepts to produce economic justification for the use of labour-intensive construction. (4) However, discussions with administrators in countries that are presently using such methods together with some of those of major international development organizations, indicate that at present only lip service at best is being paid such economic niceties and that labour-intensive methods are being used

(1) "Substitution of Labour and Equipment in Civil Construction" - Harrel et al. I.B.R.D. Washington, D.C. 1974.

"Study of Substitution of Labour and Equipment in Civil Construction."
- Scott, Wilson, Kirpatrick & Partners for I.B.R.D. Washington, D.C. 1974.

"Roads and Re-distribution" I.L.O.

"Men or Machines" Depac Lal. et al. I.L.O.

(2) "A Land-Army Project in Karnataka - India" W.G. Donovan, Development Digest October 1973.

(3) Labour Intensive Technology - Bureau of Public Highways-Manila.

(4) For the best introduction to the concept and use of "shadow" or "social" economic costing methods see
"Guidelines for Identifying & Implementing Projects to Reduce Costs in Public Construction in Developing Countries - Arthur D. Little Inc. Cambridge, Mass. for I.A.D. Washington, D.C.

as a political expediency rather than because of any economic justification. Where any economic justification may be attempted, it appears to be based mainly on market rather than social pricing methods. The concept of shadow pricing, though not too complex to understand on an intellectual level, is hard to explain in realistic terms to local profit-oriented building contractors, far less to the average tax payer.

The traditional contract method of construction is not applicable or realistic for the administration of labour-intensive work. Most contractors are not prepared (and quite rightly so) to quote binding prices on work where the labour force may be unreliable in both quality and quantity, where slight fluctuation in weather and ground conditions can cause large changes in productivity or where they are caught in the stranglehold of political or union activity. Also the logistic problems involved in housing, transporting, directing and caring for large labour forces are often outside the scope of competence of all but the largest of contractors. The best that can be expected is for labour-only type contracts given to village headmen and the like and piece- or task-work arrangements where relatively small and simple contracts are involved, and the management of the construction projects in general remains outside the control of the contractor.

One of the most comprehensive studies on the administration of labour-intensive construction has been done by the Bureau of Public Roads of the Philippines. (1) Their manual on the subject goes in great length into such fields as the size of crew, times of work, effects of weather and other such parameters. Their productivity rates, based largely on a pilot road project in Central Luzon, are most interesting when compared to the results that are obtained in other reports. There appear to be wide differences in production rates from project to project and from country to country due to various parameters such as those quoted above which can be qualified, but more important are two factors which cannot be so easily measured and on which more research work must be done. Those are supervision and manpower motivation.

An aspect of labour-intensive operations that is experienced in many countries where it is being re-introduced is the non-availability of supervisors experienced in this type of construction. The administrative

(1) Manual of Construction of Roads by Labour-Intensive Methods
- Bureau of Public Roads - Manila (unpublished)

skills required for controlling and managing large labour forces appear to have died out and the younger supervisors do not wish to involve themselves in this "low-status" branch of the industry. This is unfortunate, as the quality of such supervision and a dedication on its part to make this method of construction competitive is a most important requirement.

It is well documented that production rates over short periods (days) sometimes increase over 100 percent when piece work or task work is substituted for day work, but whether this increase can be sustained, either from a physical or social standpoint, when one is dealing with societies in which monetary gain is not all-important, has not been fully explored. The author has had experiences of large production rates by task work for a short period of days after which the limited labour force is no longer interested in further work. The average daily production over the days worked and days not worked resulted in no more than would have been obtained under a day work basis, when the schedule disruption on equipment and other work would not have been so great.

There is also a problem of providing incentives to ensure that labour-intensive methods are used whenever possible. This can be by taxation and subsidy or by legal requirements within the construction contract. No indication can be found as to whether either of these methods has proved successful. The records show that labour-intensive work is usually carried out either where the marketplace economics make it justifiable, or where government organized direct-labour projects have employed high percentages of labour as a political policy rather than an economic decision. The latter situations tend to become "make-work" social welfare projects rather than true attempts to construct facilities in a workmanlike manner using a maximum of labour. It is the bad publicity often given these projects that gives labour-intensive work the poor connotation that it has had in the past.

Interesting work has been done by the International Bank for Reconstruction and Development in the study of the health of labourers in developing countries.(1) Intervention experiments by giving iron supplements to workers have been tried and spectacular increases of about 30 percent in the productivity rates have been obtained. There are, however, no indications of large-scale use of this method of increasing production and of course, it is no substitute for a general nutritional improvement in diet which would produce the same result. It is understood that a supplement food programme was instigated by the contractor on the Mangla Dam project in Pakistan, but no details of the cost, administration or effect of this programme have been obtained.

(1) "Nutrition & Health of Indonesian Construction Workers" - Karyadi & Basta I.B.R.D. Washington, D.C.

"Iron Deficiency Anemia and the Productivity of Adult Males in Indonesia" Basta I.B.R.D. Washington, D.C.

It is expected that projects involving labour-intensive work, though not without mechanical content, will become more common in the future and that certain countries will demand it for aid projects for political rather than for economical reasons. Not only do such projects re-distribute wealth within the developing countries, reduce underemployment and use more local resources, but they also ensure that a greater percentage of the aid money remains within the local economy.

Because of the reluctance of contractors to bid labour-intensive work in the traditional manner, the high political factors involved in its organization and other factors, the management of these projects is best carried out under a modified direct labour system supervised by a competent project manager, as suggested in Section 4 of this paper.

The operation of construction equipment is an expensive undertaking at any time and more particularly in underdeveloped countries where skilled manpower is at a premium, communication difficult and the supply of spare parts limited. Despite this, the range and extent of heavy equipment to be found in such countries is amazing. The availability factor, however, is low due to breakdowns and poor operational technique and the use factor also low due to underutilization. These factors tend to further increase the cost of such equipment. Added to this are high import duties which, even in the case of development work for which duty-free equipment can be imported, is reflected in the high cost of repairs and parts.

A well known international construction company admits to over-equipping overseas work to the extent of 50 percent over North American requirements, due to excessive down-time, shortages of spares and local problems. This of course causes additional costs as only in the larger or more industrialized developed countries are modern leasing facilities available.

Local contractors tend to invest in such equipment and try to recoup the total cost on one contract because of the uncertainty of obtaining continuing work. Where older equipment is used, continuing breakdowns, lack of spare parts and often indifferent maintenance procedures cause delays and hence additional costs. The anomalies caused by such high equipment rental rates are obvious when claims for standby rental on certain equipment, due to owner caused delays, are of sufficient magnitude to cover the new purchase price of the equipment. This situation appears not uncommon.

There have been various comprehensive studies of the problems associated with the use of such equipment in development work(1) and this paper can only point out, that due to the additional cost factors, particularly the underutilization of very specialized type of equipment, managers of development construction projects should approach with caution heavy commitments in this area. When such equipment is to be acquired, it should be of a simple multi-use type rather than specialized high-capacity machines.

The availability of adequate spare parts is a problem common to equipment operation in any country, but even more so in developing countries, where all the acquisition problems discussed in Section 5 are encountered and where slow turn-over increases loss, wastage and inventory costs. In many cases it is easier and faster to import new equipment than obtain required spare-parts or carry out a major overhaul.

For these reasons it is suggested that, where the size of the development project warrants it, construction equipment be purchased by the augmenting agency and rented to the contractors or used under direct labour conditions by the project manager. Such a procedure will ensure maximum duty-free benefits should such exist, and from experience, should provide reduced total costs, particularly if such equipment can be carried over from one project to another. The acquisition of the necessary spare parts and the carrying out of necessary major overhauls would also be his responsibility, using the facilities of government purchasing departments, private organizations or direct labour. Systems of this type are already being used with some success both in private development ventures overseas and in government sponsored aid programmes.

(1) Earthmoving by Manual Labour and Machines - United Nations - New York
Achievement of Opportunities to Reduce Construction Costs in Public
Highways - Republic of Philippines - Arthur D. Little Inc., Cambridge,
Mass.

COST AND SCHEDULE CONTROL

The last category of problems regularly encountered by those involved in development construction is that of cost and schedule control. Too often additional costs and time overruns are the result of poor reporting techniques which cause those in a management position (and presumably able to exercise the authority to control or at least mitigate problems) not being notified of prospective problems until it is too late to take the necessary corrective action.

An attack on this must be two-fold, - firstly reporting methods (and the information on which such reports are based) should be improved and speeded up, and secondly decision-making levels of authority should be lowered so that the necessary time lag between a problem being encountered and the necessary remedial action being taken is reduced.

At present reporting techniques on the majority of overseas development projects are at best a method of presenting the existing cost and schedule status, and at worst a system by which, by means of half-truths, ambiguities or statistical double-talk, the situation with regard to the project (and in some cases the incompetence of those responsible for its implementation) is hidden.

The majority of international lending agencies requires only financial reports and the most fragmentary and qualitative of schedule statements. Some, it is true have gone as far as to instigate complicated CPM/PERT based reporting techniques, but these have proved costly and ineffective mainly due to the inexperience of those people involved both in the input data and in interpreting the results. The inherent problems of such sophisticated methods and their ability to hide more than they reveal make such techniques of little value in minor development projects, particularly in many developing countries where the concept of working on any schedule, be it the most simple of bar-charts, is uncommon.

There is a distinction between "cost accounting" and "cost control", the former being a bookkeeping technique based on recording payments after they have been made - a matter of record keeping, while the latter a more complicated system whereby future anticipated costs are continually being forecast, reappraised and methods for their control being suggested. There is a similar distinction between a "schedule report" and "schedule control."

Most existing cost and schedule reports are based on the accounting format so that all that is reported is past performance and where any forecasting is attempted, it is cursory in nature and ineffective as a tool on which management decisions can be made.

Not only is the factual content of these records such that little meaningful information can be obtained, but due to the time delay between the makeup of the report and its reaching anyone who can do something to relieve any foreseeable problems makes their usefulness suspect. This time delay is due not only to the effect of distance and poor communications but more important to the slow rate of bureaucratic activities through which such reports must filter before they reach high enough levels of management for remedial action to be taken.

The result of these confused reporting techniques, together with the division of responsibility for augmentation discussed in Section 3 of this paper, is that the administration of the majority of developing construction projects is based on what might be called "crisis management" whereby problems are brought directly to the attention of senior management on an individual basis (usually in person because of the inefficiency of normal reporting procedures) and action taken on a priority basis. Not only does this involve the necessity for junior supervisors to continuously refer to senior management but also causes a large proportion of the latter's time to be spent in this "fire-fighting" role rather than carrying out long-range planning, making policy decisions and seeing that they are carried out, which should be its primary functions. The "civil service" attitude, traditional lack of authority delegation and internal communication difficulties inherent in many of the augmenting authorities and discussed in Section 3 tend to aggravate this situation.

The solution to the problem of cost and scheduling control therefore, must be to, first set up a reporting system that not only records accurately the financial and scheduled status of the project, but also forecasts future trends with regards to possible cost and schedule problems, second to ensure that such reports are conscientiously forwarded and third, to make the decision-making level of responsibility close enough to the project and with sufficient authority so that the true situation with regard to the project can be seen and acted upon in a timely manner.

To improve on the cost-reporting techniques would be a specialized assignment and would of course vary in detail from project to project and within augmenting authorities. It must, however, have within it a method whereby (whether by the use of unit costs, suspense accounts or otherwise) anticipated total costs and schedule changes can be forecast with sufficient lead time to allow for remedial action. The system should also provide worthwhile total cost records in a form suitable for future estimating purposes.

More study into the make-up of such cost control procedures should be instigated on a selective basis for various specific projects.

With regard to schedule control, it is considered that a modern computer oriented reporting technique be not considered for infra-structure type development projects. Experience has shown that to use these as a regular schedule control method, as has successfully been done by some construction organizations, is not only ineffective but costly to operate in developing countries due to a lack of experienced personnel, available equipment and management enthusiasm. These techniques may however, have their place in the planning stage as a management tool in the hands of experienced personnel if such are available, who appreciate their limitations and can evaluate their results.

The regular scheduling reporting techniques suggested would be based on the most simple of bar-charts conversant with the complexity of the problem, but more important such a basic schedule must be realistic in the first place, must be adhered to by the people in the field and be updated whenever necessary so as continue as a realistic measure for the performance of the project. All too often the requirement of the contractor under the contract to produce a construction schedule is considered, both by him and unfortunately by the contract administrators, as a mere formality. It should be a detailed document, agreed to by all parties, through which progress can be judged and when diverged from should be re-evaluated and reconstructed with the same attention as the original.

The problems associated with the delay in obtaining schedule and cost information on which to take remedial action would be greatly alleviated with the introduction of the "project manager" concept and the use of a modified direct labour method of construction administration. This method of management would ensure that the people most intimately associated with the project would not only be very close to the instigation of the report (would in many cases be those making the report) but also have the responsibility and authority to make the necessary changes. This method of administration would also fragment the project to the extent where necessary actions, such as rescheduling of work, redesign, expediting of materials or even political pressure can be taken without major disruption to other aspects of the work. Such actions would cause a prime-contractor to instigate claims procedures.

In the field of cost and schedule reporting it is felt that the international lending and other financial organizations should take a

lead, not only by requiring more realistic reporting procedures, but also to instigate their own independent evaluation of cost and schedule situations of the project during the construction phase rather than wait for problems to develop by which time it is often too late to instigate remedial measures.

There is another common reason for cost and schedule overruns which cannot be reduced by any form of improved site management, administrative organization or construction techniques, and that is errors in the original estimated costs and time forecasts.

Apart from a closer examination of the qualification and experience of the persons making these original estimates - and in this regard the estimates made by recipient countries for development aid purposes are often suspect - an independent cost/schedule evaluation should be carried out.

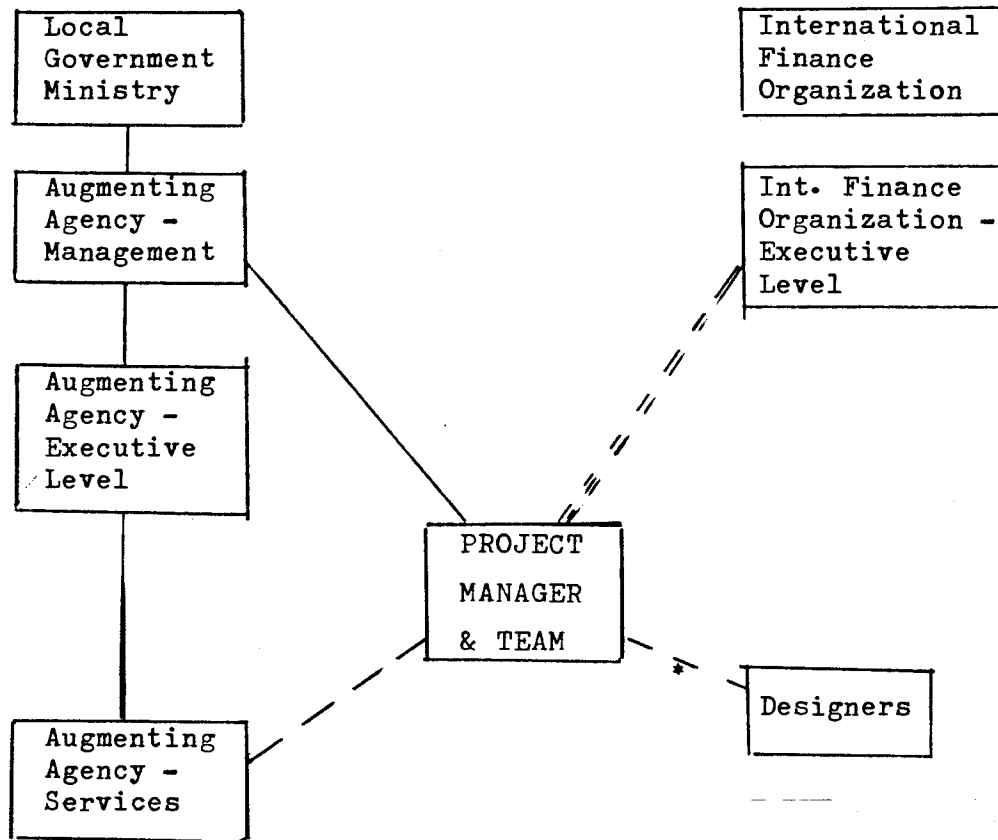
Such an evaluation should be done by a construction engineer rather than a design engineer and should be based on a total time/cost evaluation rather than unit prices and unit time methods so often used by design organizations and others not experienced in construction estimating techniques. Needless to say the person carrying out this independent evaluation should be independent of the designers and other interested parties. He should also be experienced in local conditions and construction methods employed in the area in question.

It is anticipated that by obtaining realistic original schedule and cost estimates, by instigating useful and timely reports during the progress of the work and by having the necessary responsibility and authority delegated to a project manager who is in receipt of such reports will help to overcome the present excessive cost and time increases being experienced on development construction projects.

Appendix I

PROPOSED PROJECT MANAGEMENT SYSTEM

A. Responsibility-Authority Chart

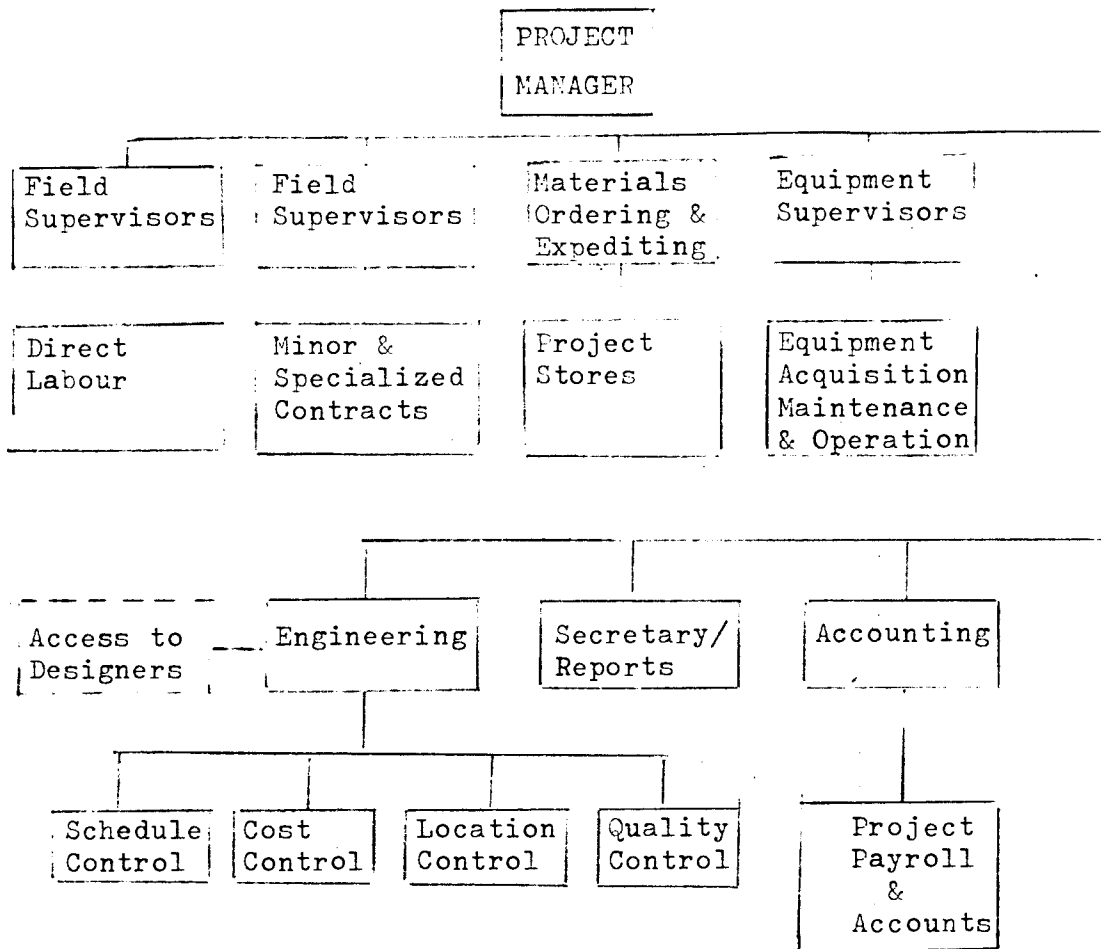


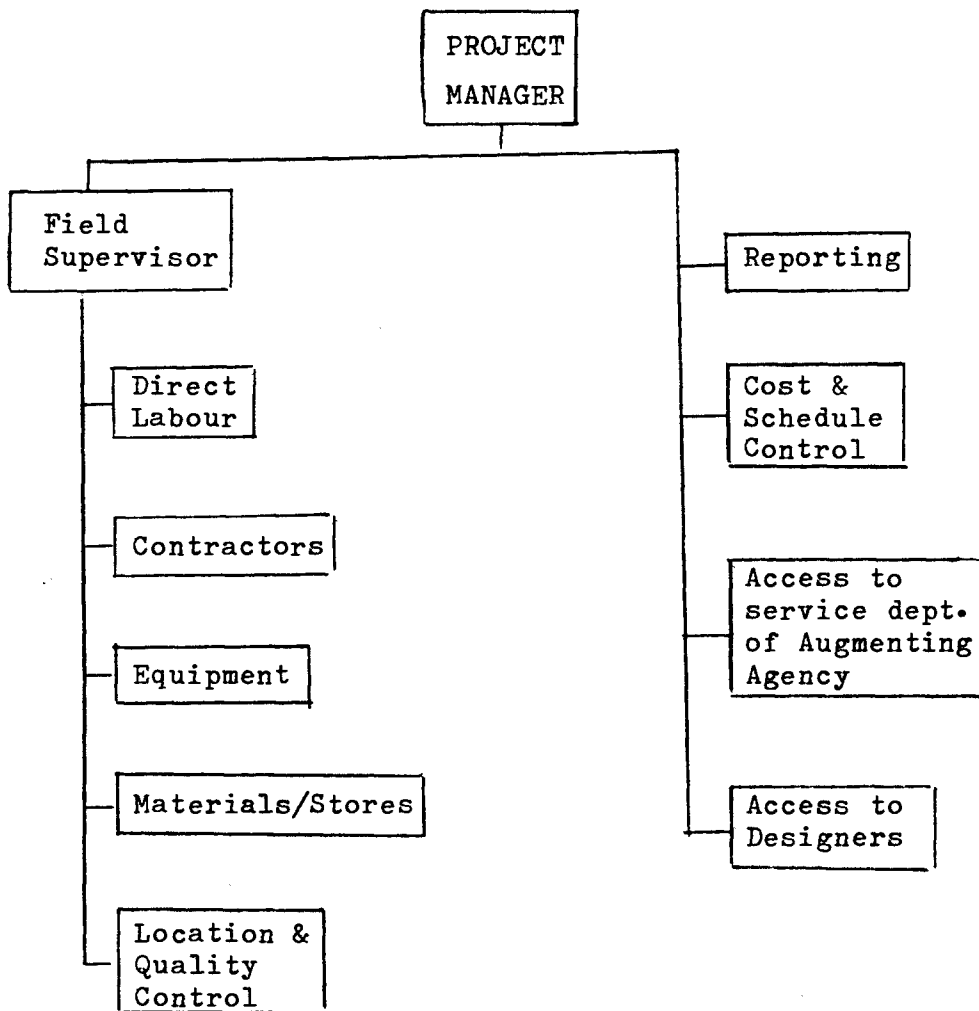
KEY

- Lines of Authority/Responsibility
- - - - Lines of Communication for Services & Consultation
- = = = Lines of Communication for Reporting.

* Note

The possibility of having the project management team responsible also for project design as well as construction has been rejected, as the latter requires different expertise. It is felt that control of the design aspects of the project would be better in the hands of the "in house" engineers of the Augmenting Agency.

B. Project Management Organization Chart - Large Projects

C. Project Management Organization - Small ProjectsNote

Under conditions such as above the project manager could be responsible for two or three minor projects, each of which would have its own full-time field supervisor.

D. Project Manager's Authority & Responsibility

1. Financial

The Project Manager shall be able to make payments within approved budgets, for labour, contracts, supplies and minor equipment/material acquisition.

The Project Manager shall award minor and/or specialized sub-contracts within budget limits.

2. Contractual

The Project Manager shall have authority to enter into, terminate and/or negotiate contracts for minor or specialized work contained in an approved budget.

The Project Manager shall not have the authority to acquire land or rights-of-way but should work within existing government agencies set up for these purposes.

3. Engineering

The Project Manager shall have full authority of quality, cost and schedule control of the project.

The Project Manager shall have direct access and authority to engage the designers on a fee basis (within stipulated limits) to carry out design or investigations with regard to the project.

The Project Manager shall have authority to make minor changes in project design with or without approval of designers or augmenting authority.

4. Personnel

The Project Manager shall have authority to transfer, engage and dismiss members of his staff below a specified level, and shall have authority to do so with senior members of his staff with prior approval of senior management of the augmenting agency.

5. Reporting

The Project Manager shall report at regular intervals (bi-weekly) to Senior Management of the augmenting agency on the financial, technical and schedule conditions of the project. Such report shall include details of any contract entered into, terminated or negotiated, changes of design instigated and any other decisions taken within his authority.

The Project Manager shall report monthly to the financial agency involved (if different from the augmenting agency) on the financial and schedule conditions of the project.

E. Qualifications for Position of Project Manager

(Depending on the size & complexity, the project manager could have less qualification than stated below which is based on a project of moderate complexity for which a staff of approximately ten to twelve people would be envisaged.)

1. Professional qualifications as Engineer, Architect or Quantity Surveyor (lesser qualification would be acceptable if extensive project management experience has been accumulated).
2. Ten years experience, preferably as a field supervisor or Resident Engineer rather than designer, academic or researcher.
3. Previous exposure to cost & schedule control and the direction of labour and equipment.
4. Sufficient maturity to inspire confidence not only in his staff but in senior management of the augmenting agency, the financial agency, contractors and the public.
5. Proven fiscal and legal responsibility.
6. Experience in working with bureaucratic government and quasi-government organizations without excessive frustration developing.
7. Experience in working on development projects in underdeveloped countries, preferably with similar climatic, cultural and technical standards. The necessity of having extensive experience in the type of development taking place (water supply, housing, roads) is not considered of paramount importance, though it would be an advantage. A broad background in augmenting development-oriented construction projects is considered of more importance.

F. Project Budget

In order for the Project Manager to operate as an independent organization, financial control by the augmenting agency or financial organization can only be obtained by him working within a comprehensive approved budget based on the original estimated cost of the project. Funds should be released to the Project Manager in accordance with this budget in lump sums depending on a time base or other schedule. Payments by the Project Manager can only be made within the allocations of this budget and expenditure outside of it or in excess of it would require prior approval of the augmenting agency and/or the financial organization, depending on their particular interrelationship.

To be workable, such a budget must be realistic and funds made available to the Project Manager in a timely manner, taking into account necessary pre-payment, mobilization costs and other non-time related funds. The following is an example of the headings under which budget allocation could be made and an allocation schedule for a minor pumphouse-pipelines-reservoir water supply project:

<u>Item</u>	<u>Description</u>	<u>Allocation Schedule</u>
1.	Pumping Equipment	On equipment delivery*
2.	Pipeline Material	On material delivery*
3.	Construction Material	On schedule basis
4.	Direct Labour	On schedule basis
5.	Consumable Supplies	On schedule basis
6.	Mobilization Costs	At start of project
7.	Clean-up & Demobilization Costs	As requested
8.	Specialized Sub-contract	On award or time basis*
9.	Approved Contracts	On award or time basis*
10.	Equipment Acquisition Costs	At start of project
11.	Equipment Operation Costs	On schedule basis
12.	Project Overhead Costs	On schedule basis
13.	Minor Misc. Costs	On schedule basis
14.	Design Cost Contingencies	At start of project
15.	General Contingencies	As requested by Project Manager

* Though funds for these items would not be released to the Project Manager at the beginning of the project, he would have the authority to purchase equipment/material or enter into contracts up to the amount covered in the budget, at any time necessary to ensure project scheduling.

MINIMUM COST - MINIMUM TIMESUPPLEMENT

A draft copy of this report was given to various interested parties, particularly within the I.B.R.D. (World Bank) and the Canadian International Development Agency, for their comments. These have been much appreciated and various views and suggestions summarized below:-

1. Development of Institutions

It was the feeling of the majority of those who commented on the report, that the project management system advocated and most of the other methods suggested for accelerating construction work were too project oriented and did not give enough consideration to the building of permanent institutions, capable not only of augmenting this and other similar projects, but also to service, maintain and otherwise protect the capital investment involved.

These critics were particularly those involved with international financing and aid organizations, and they are understandably more interested in long-term organizational reforms and the implementation of rational administrative procedures.

It is interesting to note that this criticism, though voiced to a lesser extent by independent engineering consultants, is not considered important by most augmenting agencies themselves or by those directly involved in the construction procedures. These latter people do sometimes consider the organizational disarray within the existing organizational structures to be the major bottleneck towards augmenting these development projects in a timely manner.

As pointed out in Section 1 of this paper, the recommendations contained in it are based on adapting existing operational structures rather than instigating any fundamental operational change. It is felt by the author that the social and political necessities for the majority of the infrastructure type programmes being undertaken is so pressing, that they should not be delayed in order to augment organizational changes that are in some cases politically unworkable and hence of doubtful long-term expediency. If it can be demonstrated that any particular system of management can produce results economically and on time, the local political and social factors will produce the administrative machinery to perpetuate it. In any case any organizational structure imposed from outside is doomed to failure unless there is an internal necessity for its creation.

The development of organizations has, therefore, not been considered to any great extent within this paper - not because it would not in many cases be desirable, but because the necessary time involved to develop such organizations is in itself a major reason for cost and schedule overruns on development projects.

2. The Use of Non-Governmental Agencies

The proposal within this report to make use of non-governmental agencies for procurement, purchasing and expediting duties has been criticized by many. The criticism has been not so much that these organizations would not be more efficient but, rather that such arrangements would be politically unacceptable.

This argument was expected, and considering the points of view expressed in #1 above, it is indeed hard to defend a proposal not to use such existing organizations, however, it is felt that a case can be made that such existing government purchasing and expediting agencies were designed, and may be well suited, for long-term repetitious type of purchases of a routine nature but are not qualified for obtaining the one-of-a-kind technical products required for development projects and particularly not for obtaining these in an expeditious manner suitable for the demands of the construction industry.

3. The Use of Direct Labour Construction Methods

There have been certain comments that this paper appears to be recommending the use of direct-labour (in its traditional meaning) as the most economic method in administering development projects and there is understandably some disagreement as to whether this is justified.

What this paper is recommending is that the administration and direction of labour, equipment and material acquisition be under the control of the project manager and not necessarily that labour would be paid on the traditional daily-hire basis. In fact, it is recommended that labour payments would be on a piece-work or petty-contract basis. It is the organization and schedule of this labour that is felt should be taken out of the hands of prime contractors and not the method of payment. There are still certain cases, however, such as testing and repairing pipelines, where only a daily method of payment is practical.

4. Increased Feasibility and Pre-Construction Studies

It has been suggested that an increase in the scope and quality of feasibility and other pre-construction economic and engineering studies rather than changes to the method of augmentation would reduce the chances for schedule and cost overruns on development projects.

Though it is undoubtedly true that an increase in the quality of pre-construction estimates will, by definition, reduce the amount of overruns, it has been the author's experience that overruns are as often caused by poor administration during construction than by unreliable estimates. It can, of course, be argued that a good estimator should foresee such mal-administration and allow for it in his estimate, however, such an attitude is not conducive to reducing unnecessary cost overruns.

It is considered that the majority of development projects are at present over-engineered both at the conceptual and detailed design stage - there is a possibility that they may also be over-estimated. Not only does this over-engineering cost money, but the delays to the implementation caused by them are themselves a major contributor to additional cost, both in terms of direct outlay and loss of social amenities.

5. Social Aspect of Construction Management

A valid criticism of this paper has been that little or no regard has been paid to the social conditions under which the construction activities take place, and that no consideration has been given to the social well-being and the 'quality of life' either of the labour force employed on the project or the population inhabiting the area, and for whom presumably the facility is being built.

This facet of construction management, particularly with regard to his work force, is of the utmost importance to the manager of a construction project, and all experienced managers would pay particular attention to this aspect of their responsibility, both from a broad social aspect and from a more narrow educational one. This subject has, however, been given minor consideration in this paper, not because it is unimportant, but rather because it is one that has been studied to a great extent (mainly by people not directly involved in project augmentation) and because in many cases it has been accentuated to the extent that the primary purpose of getting-the-work-done has been relegated to second place.

As stated in #1 above, time and money is running out and all those involved in the field of development must decide whether the important aspect of the work is an educational one (with its possible paternalistic connotations) or a functional one.