CONSULTANTS - Calquhoun's Report

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BACKGROUND TO PROCEDURE

ON EMPLOYMENT OF

CONSULTING ENGINEERS

June 25, 1956

Prepared by:
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CONSULTING ENGINEERS

(I) Bank's Interest in Consulting Engineers

The Bank's operations and activities are concerned with consulting engineers in the following ways:

1. Consulting engineers employed by the Bank to assist in -
   a. Project appraisal
   b. End use supervision
2. Consulting engineers employed jointly by the Bank and a member country;
3. Consulting engineers employed by borrowers for -
   a. Preliminary investigations and project reports
   b. Design and supervision of projects
4. Consulting engineers employed in member countries in connection with operations not financed by the Bank.

(II) Different Types of Consulting Engineers

Consulting engineers may, in general, be divided into the following categories:

A. Firms of professional consulting engineers

B. Firms of consulting engineers who also undertake functions performed by contractors

C. Firms of consulting engineers associated with or owned by contractors or manufacturers

D. Contractors with design offices which offer services as consulting engineers

E. Manufacturers of specialized plant with design offices which offer services as consulting engineers

F. Commercial operating organizations or nationalized industries undertaking work as consulting engineers.

Firms in Category (A) are in general nearly always members of the various Associations of Consulting Engineers in the countries of which they are based. All these Associations define a consulting engineer as a person possessing the necessary qualifications to practise in one or more of the various branches of engineering, who devotes himself to advising the public on engineering matters or to designing and supervising the construction of engineering works and for such purposes occupies and employs his own office and staff, either solely or in conjunction with another consulting engineer and is not directly or indirectly concerned or interested in commercial or manufacturing interests such as would tend to influence his exercise of independent professional judgement in the matters upon which he advises. The first and primary duty of the consulting engineer is to safeguard the interest of the client and to ensure a sound engineering job at minimum cost. Long experience has shown that this can only be achieved if the contractor as well as the client has confidence in the impartiality and fairness of those responsible for the design and supervision of the job. There are two risks to guard against, - first, actions by the contractor to the detriment of the client, such as excessive costs or inferior work, and secondly, though not so common, unfair treatment of the contractor by the client, such as failure to pay legitimate claims or the issuing of unwise, misleading or contradictory instructions. Where the relations between the client and contractor become unsatisfactory for any of the reasons mentioned above, the job is bound to suffer and in the long run

the client is the loser. It is to avoid such difficulties that there has been evolved gradually the client-consultant-contractor relationship which long experience has proved to be extremely effective. In this relationship, the consulting engineer stands between client and contractor and ensures efficient and fair treatment of both parties, as well as providing the best possible engineering advice. A consulting engineer, therefore, is one who, through special training, broad experience, proven ability and professional integrity, brings to his client technical advice of the highest quality in the fields where he practises as an expert. In all matters under the terms of reference of his appointment, he acts as the client's representative and carries out the project to the best of his ability and in the best interests of his client. Firms of consulting engineers with these high ethical standards are not and cannot always be employed for any particular project and consulting engineers in the other categories listed above may be used. Firms in Category (B) are mostly professional consulting engineers who, however, undertake functions which would not permit them to be members of one of the Associations of Consulting Engineers. Frequently they are firms of high ethical standards and can generally be regarded as being as suitable as firms in Category (A), so long as their individual limitations are recognized.

Consulting engineers under Categories (C), (D) and (E) are not independent and free, and are usually more concerned with their shareholders than their client. They have in fact to effect a compromise between the best interests of their shareholders and the best interests of their client in an effort to keep both satisfied. In general, the only effective way for a client to safeguard his own interests in employing Categories (C) and (D) as consulting engineers is to stipulate at the commencement

that, if acting as consulting engineers, they will not be permitted to tender subsequently for the construction work. Such a condition would also in general apply to Category (E) but cases arise in which firms under this category are the only possible designers of some specific type of plant or equipment. In such cases, where a specialized manufacturer, acting as consulting engineer for a project, is also to supply plant and equipment or to be permitted to tender for plant and equipment, some safeguard can be obtained by having the project checked or supervised by an independent consulting engineer who still may not be capable himself of carrying out the complete specialized designs. An excellent example of the dangers of using classifications (D) and (E) as consulting engineers has recently come to light in the case of a country which permitted a firm of manufacturers to act as consulting engineers for the designs and preparation of specifications for a water supply project. As a result of certain complaints, an independent consulting engineer was brought in to report on the plans and specifications which had been drawn up. A copy of this report is attached hereto as Appendix I.

Category (F) is self-explanatory and such organizations are usually confined to surveys and project appraisals. It is unusual and usually unsatisfactory to a client for such organizations to be used for complete design and supervision of a project.

(III) Selection of Consulting Engineers

Consulting engineering firms who are members of the professional Associations of Consulting Engineers are prevented by the rules of their Association from knowingly entering into competition for selection of consulting engineers on a competitive price basis. Such price competition is also expressly forbidden in most of the national professional institutions

of engineers such as the American Society of Civil Engineers and the Institution of Civil Engineers of England. It is not only wrong professionally but is not in the best interests of the client. This concept is well set out in an article by William Carey, until recently Executive Secretary of the American Society of Civil Engineers. This article appeared in the May 1954 issue of "Civil Engineering" and a copy is attached hereto as Appendix II. Competitive bidding for professional services on a fee basis places a premium on inefficiency and incompetency. Cheap design nearly always means high construction costs. This does not mean that price of engineering services should be neglected in negotiations for the selection of a consulting engineer but qualifications other than the cost of fees should carry most of the weight in selection of professional services. In making inquiries from consulting engineering firms, therefore, for their possible use for professional services, certain questions should be asked and the answers to these questions should form the main basis in the selection of consulting engineers, rather than the fees which they may require for undertaking the work. There are a number of questions which in general should always be asked in considering the selection of a firm of consulting engineers:

1. What are the qualifications of the firm for undertaking the project in question?
2. What classes of work have they undertaken in the past?
3. What size staff do they employ and what volume of work have they on hand at the time in question?
4. In what countries have they worked?
5. What staff would they propose to assign to the present project?
6. What are the qualifications of each of the staff?
7. How would they propose to tackle the job?

8. What would be their time schedule for the work contemplated?

9. What items of work or investigation would they cover?

10. Lastly, - what fees would they charge?

On the basis of the answers to all these questions, the selected consulting engineer should be required by the client to present himself in order that the client may appraise his general character and demeanour and discuss with him the project in general, so that he may finally negotiate an agreement with him for the work in question.

The safest and best procedure for an owner or client to adopt in the appointment of his consulting engineers is as follows:

(1) To prepare a list from personal knowledge or recommendations by qualified sources, such as other employers or engineering societies, of firms of consulting engineers considered suitable for the project in question.

(2) To invite the firms on that list to submit their qualifications, experience and capacity for undertaking the project on behalf of the client.

(3) To select from these proposals one or more consulting engineers to be interviewed.

(4) To determine which one of the consulting engineers interviewed is best qualified for the particular engagement under consideration.

(5) To negotiate with the consulting engineer so selected for services of the nature and extent required. The reasonableness of the fees to be charged may be checked from personal knowledge or from other employers or engineering societies.

(6) To enter into an agreement with the consulting engineers selected on the basis of the negotiations for the services

required. Engagements involving preliminary investigations and reports should commit the consulting engineer to limiting fees in case additional engineering services are required at a later date on the same project.

As a further safeguard, the Federation Internationale des Ingenieurs Conseils or International Federation of Consulting Engineers, commonly called F.I.D.I.C. is always ready and willing to give advice on the selection and appointment of professional firms of consulting engineers.

(IV) Duties of Consulting Engineers

It is worthwhile explaining in general terms the normally accepted duties of a consulting engineer. When a project is conceived by an authority or industrialist, many factors connected with the scheme may be unknown. It may, for instance, be desired to store water on a monsoon-fed river for irrigation and power generation purposes. Before even the most preliminary designs can be made, many data must be collected, and if the authority does not have the personnel available, the study of the whole scheme could be handed over to consulting engineers.

If the preliminary investigation indicates the practicability of the scheme, and it is decided to proceed with further investigations, it would be the duty of the consultants to carry out ground surveys for the structures and buildings, or arrange on behalf of the client for test borings, trial pits, test piling, etc. and for the supply of any models and other investigations which may be required. They would select the best type of civil works or buildings and the correct pressure for boilers and generating plant, the most suitable types of water turbines or other plant and machinery. In fact, they would advise on all matters connected with the scheme.

On the result of the tests and investigations, the consulting engineers would be able to complete the Project Report from which the final decision would be taken regarding actual construction work. When the Project Report is accepted and the consulting engineers appointed

for the complete scheme, it is their duty to draw up all detail plans, designs and specifications, as well as the forms of tender and conditions of contract.

The consulting engineers would advertise or negotiate on behalf of the client for tenders and on receipt of them would advise the client as to the most acceptable offer. On the appointment of a contractor, the consultants would approve the contractor's working drawings, inspect the plant during manufacture, and supervise all the work during construction. Finally, when the works are completed, they would carry out the taking-over tests, certify their correctness, and hand over the completed job to the clients ready for normal operation. After the construction work is completed, they would, if required, assist the client during the preliminary operational stages.

Thus the consulting engineers relieve the client of all the detailed engineering work during the construction period and so enable him to concentrate on building up the permanent organization which will be required for operating the works when completed. They do, however, carry out their work in collaboration with the client so as to ensure that the completed works are such as to fulfil his requirements.

Where the client is engaged on large-scale operations embracing a regular programme of construction extending over many years, it is, of course, usual for the client to have a permanent engineering organization and for the consulting engineers to be brought in for special advice and to deal with certain of the larger schemes which might otherwise overtax the resources of the client's permanent organization. In this event, the consulting engineers naturally maintain close collaboration with the client's chief engineer and his staff throughout the progress of

the work and in particular consult with them on all major questions of design and placing of contracts.

The services rendered by consulting engineers are a necessary part of any engineering undertaking. That is to say, these services have to be carried out whether consulting engineers are employed or not. Consequently, the cost of these services is an inevitable part of the cost of the job. Long experience has shown that in most cases these costs are greater if the work is undertaken by the promoter of the project, since he does not have the special experience or organization necessary for such duties. If the work is undertaken by the contractor, the extra cost will appear in the contract price, with the disadvantage that the client is very largely in the contractor's hands, and the work is inevitably designed and organized to meet the contractor's commitments. The consulting engineer, on the other hand, has built up his organization with the primary object of providing such services in the most efficient and impartial manner at the lowest possible cost.

Consulting engineering is a profession, just as those of medicine, the law, architecture, etc., and its members are bound by codes of conduct and professional etiquette.

The employment of consulting engineers is not peculiar to any one part of the world. In most countries, their value and duties are well known, and even though the large railway companies, dock authorities, electricity supply authorities, manufacturing firms and Government Public Works Departments have their own trained engineers for normal work, the broader experience and specialist knowledge of consulting engineers is often called upon when major new schemes are launched. This may be compared with the normal practice in the medical profession of obtaining a second opinion or of calling in a specialist.

It should be appreciated by the client that the consulting engineer is just as interested as the client in early completion of the work, since the later the completion, the heavier the overhead charges which the engineer has to face. The greater the time to complete the works, the greater is the financial strain on the engineer, but his extensive experience generally enables many pitfalls to be avoided which might otherwise lengthen the construction period. It is in all these ways that a consulting engineer can render services to his client and act in his best interests, where others undertaking the same work cannot be of the same value to the client.

(V) Terms of Reference

Wherever possible, terms of reference covering what the consulting engineer is required to do should be given to him at the time that he is asked to put forward his proposals. These terms of reference will vary from project to project, but in general many of the terms will be required in a similar form in all projects, but separate terms of reference will be required for -

1. Preliminary investigations and project reports;
2. Designs, specifications, preparation of contract documents and supervision.

It is possible to draw up model lists of these terms of reference which are mainly of general application to all jobs, providing it is borne in mind that not all items are applicable to every job.

1. Preliminary investigations and project reports -

   a. General consultation with client as to his requirements;
   b. Preliminary site surveys, such as may be necessary for the purpose of the project report;

c. Investigation of all available data or information relating to the proposed works;

d. Advice to the client as to the necessity for special investigations of conditions of subsoil, tide or weather;

e. Arranging for the carrying out of such bore holes, test piles, trial pits, soundings, marine or hydrological investigations as may be necessary;

f. Interpretation of the results of such investigations;

g. Preparation of sketch plans, showing the project in general outline;

h. Preparation of market studies;

i. Preparation of traffic studies;

j. Investigation and recommendations on proposed or existing management;

k. Preparation of economic study of the project;

l. Consideration and recommendation on operation of the project when completed;

m. Consideration of commercial feasibility of the project;

n. Estimates of cost of construction;

o. Estimates of time schedules and programs for construction;

p. Proposed rates for operation;

q. Consideration of international boundaries where applicable;

r. Consideration of associated works necessary, such as temporary housing, access roads;

s. Consideration of compensations which may be payable, such as for flooding land;

t. Recommendations on purchase or acquisition of land;

u. Consultation with any architect or other advisor appointed by the client in regard to architectural treatment or other features of the works.

2. Designs, specifications, preparation of contract documents and supervision -

a. Preparation of detailed site surveys;

b. The making of designs, drawings, specifications and preparing schedules or bills of quantities;

c. The preparing of conditions of contract, forms of tender and invitations to tender and submitting these for approval and decision by the client;

d. Advising the client as to lists of tenderers.

e. Advising the client as to tenders, tenderers, prices and estimates for the carrying out of the works;

f. Advising as to the preparation of the contract relating to accepted tenders;

g. Preparing any further plans, designs and contracts necessary for the carrying out of the works;

h. Examining and approving contractors' and manufacturers' details;

i. Making arrangements on behalf of the client for the inspection and testing during manufacture of such materials and plant as are usually inspected and tested;

j. Issuing instructions to contractors and manufacturers and generally supervising the execution of the works;

k. Providing time schedules and progress reports;

l. Providing forecasts of funds required;

m. Issuing of certificates for payments to contractors and manufacturers;

n. Supervising acceptance tests on site;

o. Assisting in settling disputes or differences that may arise between the client and contractors excepting litigation and arbitration;

p. Providing the client on completion of the works with such record drawings as are necessary for operation and maintenance;

q. Assisting the client in organizing management;

r. Assisting the client on putting the project into operation and organizing and training an operating staff.

(VI) Fees for Consulting Engineers

The remuneration of the consulting engineers for the performance of their service as outlined above can be made in a variety of ways. Two or more methods may be combined in any project and fees should be agreed beforehand to suit each particular case. The following are the bases usually employed:

(1) Percentage of cost. (Fee based on a percentage of actual cost of work contemplated or constructed.)

(2) Fixed lump sum fee

(3) Cost plus a fixed fee

(4) Daily or hourly rates

(5) Cost plus basis where scope of work is difficult to determine

(6) Retainer fees

The decision concerning the acceptable method of computing fees on a particular job necessitates consideration of various important items, each of which has a bearing on the agreement for service to be entered into between the engineer and his client, as each agreement should be drawn to meet specific conditions. The following description

of each of these methods of calculating fees is taken from the Manual of Professional Practice of the American Society of Civil Engineers, but is applicable to all consulting engineers generally throughout the world.

Percentage of Cost of Work

Compensation based on a percentage of the final net cost of construction is the usual and most convenient method.

If the services cover only estimating and design or if the construction is postponed or cancelled, compensation is based on the estimated construction cost as determined by the Engineer.

Cost of work constitutes the adtual total construction cost in place, including labor, materials, equipment, etc., but excluding the engineering cost. Also excluded as items of "net cost" are the cost of financing, commissions, cost of real estate, legal and other similar expense.

Fixed Lump Sum Fee

Compensation under this method is usually arrived at by negotiation in which the amount of the fixed lump sum may be deterrined by either of two methods. In the first and preferable method, the lump sum fee is determined by applying a percentage to the estimated construction cost, and stating the result as a lump sum.

The second method may be used in cases where the estimated construction cost is difficult to determine but where the client desires to develop a lump sum fee for the engineering service required. In this method, the lump sum fee is the sum of the following three items:

a. Estimated direct payroll costs.

b. Estimated overhead costs as defined (page 16).

c. A surcharge on the total of (a) and (b) above of not less than 50% of that total representing compensation and profit to the engineer.

In addition, the engineer should be reimbursed for all travel, subsistence and other out-of-pocket expenses directly chargeable to the work. In instances where unusual specialized skill and judgment are required, the above method plus a per diem is recommended.

Under this method, the agreement should include a stated time limit for the performance of the services and a provision for additional compensation for changes required to be made after preliminary plans have been approved. Further provision should be made for equitable adjustment in compensation in case the original project is expanded or reduced in scope.

Cost Plus a Fixed Fee

For many civil engineering projects, the engineer is required to start work before the scope of the project can be accurately defined and estimated. This indeterminate project scope generally results from the requirement for special studies, research or experimental work, preparation of estimates for alternate types of construction, etc.

For this type of project, the cost plus a fixed fee method offers a satisfactory basis for performing such service.

Under cost plus fixed fee agreements the engineer is reimbursed for the direct cost of services, supplies, etc., including:

a. Salaries of engineers, designers, draftsmen and other technical employees engaged on the project.

b. Drafting, clerical and stenographic expenses and supplies.

c. Blueprinting, photostating, printing and other reproduction costs.

d. Telephone, telegraph and postage expenses.

e. Travel and living expenses of principals and other employees on business connected with the project.

f. The cost of any other items directly chargeable to the work or agreed to be included at the time the agreement is made.

If the services are performed in the engineer's home office, the applicable indirect or overhead expenses of the engineer are properly added to the direct costs. Overhead is generally computed as a percentage of the productive payroll, i.e. the salaries of engineers, designers, draftsmen and other technical employees while engaged on the project.

Cost plus fixed fee services at times are required to be performed in a field office at or near the site of the project. The consideration dictating this procedure is generally the necessity of getting the project started as soon as possible, the plans being developed as the construction work proceeds.

The computation of the applicable overhead allowance for cost plus fixed fee services performed in a field office may be subject to negotiation between the engineer and the client. Such services absorb a certain capacity of the engineer to take on additional work, and an equitable charge for overhead is justified.

In addition to reimbursement for direct and indirect costs, the engineer is paid a fixed fee, which usually ranges from 2% to 4% of the construction cost depending on the size and character of the project and scope of the engineering services involved. In many cases, the fixed fee is calculated as a percentage of the estimated construction cost as determined by the Engineer.

Daily or Hourly Rates

The per diem basis of compensation is particularly adapted to Court work or similar work involving irregular personal service.

When such consulting or expert services are furnished, the engineer is compensated for all time devoted to the work, including time of travel. The per diem fee should be based on the complexity of the work involved

and the breadth of experience of the engineer. In addition to the compensation based on the per diem, the engineer is reimbursed for travel, subsistence and other out-of-pocket expense incurred while away from his home office.

For Court work or other engagements on which the engineer is to appear as an expert, a per diem is considered to have been earned for each day of such appearance, although he may not be called to testify, or if called, may finish his testimony in a fraction of the day.

On occasions, the urgency of the engagement requires the engineer to work longer than the customary seven or eight-hour day. In such instances, an understanding with the client should be made as to what constitutes a per diem, as the urgency may require the engineer to work more than the usual hours per day in order to complete his work. In such cases, the per diem may be based on the normal number of working hours per day or the per diem rate may be increased to take into consideration the extended work day.

For certain kinds of work, compensation based on hourly rates makes an equitable arrangement. Compensation for engineering service on an hourly basis demands a higher rate per hour than would be represented in a per diem rate. Also, the hourly rates should apply to time required for travel involved, plus reimbursement for travel costs, subsistence and other out-of-pocket expenses. Depending on the duration of the services, compensation on an hourly basis may fairly include an agreement on an upset minimum amount or retainer in addition to the payments based on the hourly rates.

Cost plus Basis where Scope of Work is Difficult to Determine

There are numerous cases where the extent of the engineering service required is difficult, if not impossible, to pre-determine. Under such

circumstances it is impossible to establish fees as a percentage of estimated construction cost. In this general classification and where partners' or officers' time comprises a major portion of the engineering costs, per diem rates mutually agreed to by the client and the engineer are recommended, with reimbursement for travel, subsistence and other direct expenses.

In other cases in this classification, a reasonable fee may be developed by use of the second method outlined in "Fixed Lump Sum Fee".

In still other cases of this general type, the cost plus a fixed fee method, as previously outlined, will provide the best basis for negotiating the fee.

Retainer Fees

The employment of engineers on a retainer fee basis is a common practice of clients who wish to be assured of always having available in the future the services of a certain individual engineer or organization.

This method is used in cases of protracted litigation, when the calls upon the engineer may be intermittent. It is also used in the development of undertakings for which the services of an engineering specialist are not required on a full time basis. Industrial companies may also employ on a retaining fee basis the engineers who prepared the plans and specifications for manufacturing plants and thus are familiar with any problems arising from maintenance or plant additions.

The amount of the retainer varies with the character and value of the services to the client and the reputation and standing of the engineer in his profession.

The terms of agreements for services on a retainer fee basis also vary widely. The compensation may be based on a fixed sum, paid monthly

or on some other mutually agreeable basis, with per diem or hourly rates in addition for time spent at the request of the client.

In any case, the same principles as explained previously for per diem or hourly charges govern in their use under retaining fee agreements.

Overhead

Overhead may be defined as those costs incurred which do not contribute to the solution of the engineering problems at hand, but which are nevertheless essential to the continued operation of an engineering business. Depending upon the size of the engineering organization, items of overhead expense may include any or all of the following:

Rent, including utilities; administrative expenses of conducting business, accounting and purchasing, business promotion, clerical and stenographic help, unallocated salaries, taxes except Federal and State income taxes, office supplies and equipment, insurance, including life insurance on officers of the firm, telephone and telegraph; legal expenses; bad debt provision, depreciation on furniture and equipment; library and periodical expense.

The following are also commonly included as items of overhead: Social Security, unemployment, excise and payroll taxes, employees' compensation insurance, sick leave, vacation and holiday pay. Under some methods of accounting, the items in the previous sentence are considered as a part of direct payroll or salary cost. Overhead is commonly expressed as a percentage of productive payroll, i.e., the salaries of engineers, assistants, designers, draftsmen and other technical employees engaged on the project.

The amount of overhead cost incurred will vary from month to month and from job to job, depending upon the type of work and work load in which

the engineering firm is currently engaged. Overhead may range from as low as 25% to 100% and more of direct costs.

Re-use of Plans

Plans represent the product of training, experience and professional skill and accordingly belong to and remain the property of the producer unless specifically agreed to the contrary. Certain engineering organizations systematically cover by "copyright" all plans, sketches, and designs prepared by them in order to protect themselves in possible cases of piracy of their ideas.

While direct copying of engineering designs is infrequent, in submitting novel designs or plans solving difficult problems in construction, the engineer should protect them either by copyright or by requiring the recognition of ownership through a proper provision in the contract for service or both.

Interim Payments

Interim payments for engineering services should be provided for as the work proceeds. Provision should be made for compensation, if for any reason the work is abandoned or deferred. The details covering payments may differ with each job according to the conditions involved. It is quite customary for an interim amount to become due and payable when a preliminary study is completed and the report rendered, and again when detailed plans and specifications are completed or when the construction contracts have been signed. Sometimes such arrangements for interim payments are made on a more frequent basis. In any case, interim payments should be made promptly after the engineer has completed each phase of his work whether or not the next phase is begun.

Items to be paid for in addition to Percentage Fee

The following items of cost cannot be determined accurately in advance and are not within the sole control of the engineer. Ordinarily they are paid for in addition to the percentage fee in the manner stated and the engineer should keep separate complete accounts of these five items:

1. Field surveys, property, boundary and right-of-way surveys, flow gaging, specialized sub-surface investigations, or similar instrumental work for preliminary investigations and report; instrument surveys for design; and services of resident engineers and inspectors.

A fee based on salary cost plus 100 percent, plus reimbursement for actual travelling and subsistence expense, long distance telephone and telegraph charges and similar direct field expense.

2. Services of locally employed field staff additional to resident engineer and inspectors:

A charge based on salary cost plus 50 percent, plus reimbursement for necessarily incurred travelling and subsistence expense and supplies.

3. Furnishing reproduction of drawings or of detailed plans and specifications.

At cost plus 50 percent service charge, or at price agreed upon with the client.

4. Services during readvertisement for bids for construction:

A charge based on salary cost plus 50 percent, plus reimbursement for necessarily incurred travelling and subsistence expense, long-distance telephone and telegraph charges, and payment at recommended rate for needed additional copies of plans and specifications.

Limiting lump sums for the above services are often included in engineering contracts.

5. The client should pay directly, and in addition to the percentage fee, for special tests and research, mill and shop inspection of materials and equipments, sampling and analyses of water and sewage and for foundation explorations such as borings, test pits and soil mechanics laboratory investigations, whether for preparation of preliminary report with estimated cost, or for final detailed plans and specifications.

Litigation

Nothing should be written in the engineering agreement to obligate the engineer to prepare for or appear in litigation in behalf of the client, except in consideration of additional compensation.

Re-design required by Client

When re-design of work is required by the client after the preliminary report or preliminary plans have been approved, compensation for such re-design should be on basis of salary cost of employees plus 100 percent in addition thereto for allowance for overhead and principals' time. In addition, reimbursement should be made for travelling and subsistence expense, long-distance telephone and telegraph charges and similar direct expense occasioned by the work of re-design.

(VII) Relations of the Engineer with the Client

It is valuable to outline the relations of the consulting engineer with his client as normally accepted.

1. The engineer may act as designer, supervisor of construction, professional adviser to the Owner, or in all three capacities, or in combination of these capacities. He shall act in a strictly judicial manner.

2. The engineer is entitled to compensation for professional advice. He should not offer such advice free. His charges for services should conform to general practice and should always be adequate to permit conscientious compliance with assumed obligations.

3. Unless authorized by the owner, he shall not receive directly or indirectly any royalty, gratuity or commission on any patented or protected article or process used in connection with work upon which he is retained by the Owner; nor shall he accept without the Owner's consent any trade commissions, discounts, allowances, indirect profits or other secondary considerations in connections with any professional service which he undertakes for the Owner.

4. He shall not directly or indirectly engage in any of the building trades while practicing professionally.

5. He shall inform the Owner of any business connections, interests, or circumstances which might influence his judgment or the quality of his services.

6. Consultation with engineers who have made certain branches of professional work a specialty, or who have acquired a pre-eminent standing should be encouraged by the engineer having general charge of any work, and may be required by the Owner. In either case, the engagement of the consulting engineer should be satisfactory to both the owner and engineer and shall be at the expense of the owner.

No engineer shall agree to act as consulting engineer except at the request or with the knowledge of the engineer in direct charge of the work; and his reports and advice should be confined to the particular matters upon which he has been consulted.

Charges for consultation should take into account the value of the services rendered as well as the time spent in arriving at conclusions or opinions.

7. The engineer when acting as supervisor is the official interpreter of the agreement and shall insist upon its faithful performance by both parties.

8. Planning, designing and supervising are the functions of the engineer. All problems involving these functions should be presented to the engineer rather than to the contractor.

9. As a complete service, the engineer shall furnish promptly whatever general, structural and mechanical plans, details and specifications are needed for bidders or contractors. He shall not require bidders, contractors or sub-contractors to make gratuitously drawings or specifications which it is his duty to furnish.

10. He shall not attempt to conceal possible oversights or errors, nor to shirk responsibility by indefinite clauses in contracts or specifications. Specifications shall clearly define unusual trade terms or trade names and customs understood to be part of the specifications.

11. The engineer will generally find it advantageous to himself and to the owner, before plans and specifications are detailed, to have the owner committed to a program of awarding contracts; that is, to have him decide whether he will let a general, a segregated, a lump-sum, a cost-plus fee, a unit price or other form of contract.

12. The engineer is entrusted with financial undertakings in which his honesty of purpose must be above suspicion; he acts as professional adviser to the owner and his advice must be absolutely disinterested;

he is charged with the exercise of judicial functions as between owner and contractor and must act with entire impartiality; he has moral responsibilities to his professional associates and subordinates; finally, he is engaged in a profession which carries with it grave responsibility to the public.

(VIII) Approvals and Recommendations by the Bank

In general, for all projects of an engineering nature for which applications may be made to the Bank for consideration for loans or other purposes, the Bank will require a report covering investigations, estimates and project appraisals. For this purpose, the Bank will require that consulting engineers shall be appointed to prepare the project report on the basis of terms of reference such as those outlined above for preliminary investigations and project reports (page 10). In general, in all cases of project development involving engineering, the Bank will require the appointment of consulting engineers for the design and supervision of execution of the project. Such engineers will be appointed on the basis of terms of reference such as those outlined above for design and supervision of construction (page 12). Whether consulting engineers are appointed by a member country of the Bank or borrower, before or after an approach has been made to the Bank, the Bank in all cases reserves the right to approve of the consulting engineers appointed and to approve of the terms of reference given to the consulting engineers. In accordance with the Bank's policy, firms would not be approved from countries which are not members of the Bank, except Switzerland. Where consulting engineers have not been appointed before an approach is made to the Bank, the Bank would agree with the

borrower on the terms of reference to be given to the consulting engineers and where the borrower is unable to prepare these terms of reference for himself, or asks the Bank to assist in the matter, the Bank would assist by recommending suitable terms of reference to the borrower, based on the lists above. In considering the appointment of consulting engineers, the Bank would, if necessary, advise the borrower on the questions to be asked from the proposed or contesting firms of consulting engineers as outlined in "Selection of Consulting Engineers"(Page 4) for the purpose of enabling the borrower to make his selection of consulting engineers and where the Bank is to give approval of consulting engineers, the borrower should be required to submit to the Bank the answers to the various questions which he has received from the proposed or contesting firms of consulting engineers. In the event of the member country or prospective borrower not knowing how to proceed with the appointment of consulting engineers, the Bank would be willing to assist in this respect, advising the borrower on the questions to be asked and terms of reference to be given to the consulting engineers. In the event of the member country or prospective borrower still further requiring assistance in the names of suitable firms of consulting engineers to approach, but only if necessary, the Bank would be willing to provide such a list. In doing so, the Bank, in preparing a list of firms of consulting engineers for submission to the member country or prospective borrower, would have regard to the following points:

(1) That the list should, where possible, be restricted to firms of consulting engineers in Categories (A) and (B) and that firms in categories (C), (D), (E) and (F) should not be included in the list unless essential

or necessary because of some specific reasons involved in some particular cases. A list containing a mixture of firms from Categories (a) to (F) is not advisable. Where firms in Categories (a) and (b) are not available and suitable, then selections can be made, according to circumstances, from Categories (c), (D), (E) and (F).

(2) The list should be as international as possible, having regard to the circumstances of each particular case. It should be remembered that some countries such as the U.S.A. and U.K. have a far larger number of firms of consulting engineers than some other countries such as Holland, Sweden or Italy, which may have only one or two firms. In order to maintain an even balance, therefore, an international list should contain a larger number of firms from the U.S.A. and U.K. than from other countries.

(3) The list should be varied as much as possible, that is to say, a firm should not be recommended on two consecutive lists if other equally suitable firms are available and suitable for the same work.

(4) Consideration should be given to the known load and capacity of the firms considered for a list.

(5) Consideration should be given to the experience of the firms in the class of work to be undertaken.

(6) Consideration should be given to the experience of the firms in various parts of the world and particularly in the vicinity of the work to be undertaken.

Based on the above considerations, suitable lists for submission to the client can be prepared in the Bank from an examination of the information which the Bank maintains about consulting engineers and with this list the client can act in accordance with the procedure outlined above.

When the Bank is required to prepare a list of consulting engineers for submission to the client, the list should be accompanied by the following qualifications:

1. That the list is not exhaustive;

2. That the firms named are qualified but that whether any of them should be employed must depend, among other things, on the number and qualifications of the staff who can be made available for the particular project;

3. That the client is free to invite proposals from any firm of consulting engineers not included in the list, provided that before any actual appointment is made, the Bank's approval of the firm is sought if its name is not included in the list submitted by the Bank, the assumption being that further approval is not required by the Bank if any one of the firms on its recommended list is chosen, as these would not be put on the list if the Bank were not prepared to approve of them, subject always, of course, to their proposals being acceptable.

4. That the client shall provide suitable terms of reference which shall be previously agreed with the Bank;

5. That in seeking proposals from the consulting engineers, the client shall adopt the procedure outlined above and require the proposed firms of consulting engineers to answer the questions given above as may be agreed between the client and the Bank.

Where the client submits a list of proposed names of consulting engineers to the Bank, the Bank would give consideration to the following circumstances:

1. That the list is all from one country or not sufficiently international;

2. That any of the firms are not qualified;

3. That there are other better firms not included in the list;

4. That the list contains a mixture of firms from Categories other than (A) and (B).

At as early a stage as possible in discussions between the Bank and the client in regard to the appointment of consulting engineers, the Bank would make known to the client its desire that as far as possible, and providing circumstances permit, the selection of consulting engineers should be from Categories (A) and (B). In special cases, organisations from Category (E) need not be ruled out. It is, however, unreasonable and unfair to expect firms of consulting engineers normally to be able to compare on price with nationalised industries or government departments such as Electricite de France or the U.S. Bureau of Reclamation. In the event of a client wishing to appoint a firm from Categories (C), (D) or (E), the client shall make clear to such firm or firms at the earliest stage that in the event of their undertaking work as consulting engineers, and providing a Bank loan should result, they or their associated firms would not be permitted to take part in tendering for contracts for construction or the supply of equipment or plant. In other words, a firm which undertakes contracting work or manufacture of plant and equipment as well as consulting engineering must make up its mind at the initial stage whether it wishes, in that particular project, to act as consulting engineers or to act as contractors or suppliers and it should be made quite clear to them that for a project with a Bank loan or in which the Bank is interested in any other way, it would not be permissible to act as both consulting engineer and contractor, or as both consulting engineer and supplier.

There has recently come to light the action which has been taken by the Ceylon Government in connection with Stage 2 of the Aberdeen-Laksapana Hydroelectric Scheme. Attached hereto as Appendix III is a

copy of a letter dated 12th December, 1955, which the Ministry of Transport and Works of the Ceylon Government has sent out to a number of firms of consulting engineers, contractors and others. This is a clear case where the Department of the Government concerned does not appreciate the implications of the circular letter which it has issued. Should they proceed with the scheme on the basis of this letter, whether with or without a Bank loan, by appointing a firm or firms which have put in proposals in accordance with this letter, they would be laying up trouble for themselves which would probably result in increased costs, inferior work and possibly even litigation.

It is cases such as this, which are not isolated ones, which make it necessary that the Bank should inform the borrower at the earliest stage of its views in regard to the appointment of consulting engineers and ensure that the prospective borrower fully understands the difference between consulting engineers and constructing firms and suppliers, and the implications involved in undertaking work on a basis such as that outlined in the letter from the Ceylon Government.

The Bank would reserve to itself the right to approve or comment on the proposed agreement with the consulting engineers, which agreement should include in all cases the terms of reference.

(IX) The Bank's Requirements and Commitments in regard to Consulting Engineers

Where the Bank has approved the appointment of consulting engineers either for preliminary investigations and project reports or for design and supervision of construction, it should regard the consulting engineers as advisers and consultants to the client, acting in the client's best interests and through the client to the Bank itself. In other words, they should be regarded in the same light as one would regard

advice from a surgeon or lawyer. The Bank should regard their advice as being the best obtainable and would accept such advice except in unusual circumstances or for very special reasons. It is not professional or ethical for a firm of consulting engineers to report on the work of another consulting engineer except with the latter's knowledge and approval or if his appointment has been terminated. A reputable and ethical firm of consulting engineers would not undertake such an assignment without assurances on these points. The Bank is not necessarily committed or bound by the advice and recommendations of consulting engineers, but in appointing or recommending or approving their appointment, should be willing to have sufficient confidence in them to accept their recommendations and proposals, unless and until circumstances should warrant otherwise. Should the Bank not be satisfied with the work of consulting engineers, they should be free to discuss the matter with the client and the consulting engineers and in the event of the Bank not being satisfied with some action taken or advice or recommendations, they should be free to consider whether they have lost confidence in the consulting engineers to such an extent that it would be desirable to terminate their appointment or require the client to do so and appoint others. It is advisable that the Bank should reserve to itself the right to -

1. Approve or comment on proposals received by the client from consulting engineers,
2. Take steps to ensure that the consulting engineers have the authority to carry out their responsibilities efficiently,

3. Maintain direct relations with its borrowers' consulting engineers, but only if necessary,

4. Give the consulting engineers support in their relations with borrowers,

5. Require the borrower to advise it of cases in which the borrower acts contrary to the advice of the consulting engineers.

The Bank should require the consulting engineers, where possible, to draw up all specifications and plans in such a way as to be suitable for international tendering, and where international tendering is possible, no specification should be drawn up in such a way as to give advantage to one country's contractors or manufacturers. Where, in documents, it is advisable or necessary to specify an article or method of work by reference to a particular firm's manufacture of an article or method of work, the words "or other approved" should be added at the end of the sentence specifying such article or method of work. Where a specification is drawn up in such a way that it favors one particular country, and it is not possible to include alternative specifications to cover all countries, a clause such as the following should be added at the end of the specification or specifications:

"Any firm tendering and unable to comply with this specification or specifications, by reason of country or common usage such as because of different standards normally adopted in the country of the firm tendering, should tender on the basis of specifications and materials normally adopted in the country to which the firm is accustomed, providing such standards are at least equal in quality to the articles or methods specified or implied in these specifications."

Where a tenderer wishes to put forward alternative proposals by reason of his views on the proposed designs or specifications, but not by reason of different standards in the country from which he works (which is covered by the above clause) he should be permitted to submit his alternative proposals, provided always that he also submits a tender based on the designs and specifications provided (except as varied by the above two clauses).

These requirements of the Bank in regard to the work of consulting engineers might be included in an appropriate form in the Bank Loan Agreements.

K) Consulting Engineers' Agreements and Fees

It may be useful for the Bank to have a model form of agreement of a type which is normal as between a consulting engineer and his client. Such a form might be of value when the Bank is discussing with borrowers the appointment of consulting engineers and would be a guide to borrowers who may not be familiar with such agreements. It must be remembered, however, that no two sets of circumstances in regard to the appointment of consulting engineers are usually alike and, therefore, no model form will be acceptable in all circumstances and must be adjusted to suit each set of conditions. In other words, it can normally only be taken as a guide and used as a basis to prepare an agreement in each particular case. Such a model form of agreement is attached hereto as Appendix IV. This form has been taken from the Model Forms of Agreements published by the Association of Consulting Engineers of Great Britain and is probably generally acceptable to all professional firms of consulting engineers throughout the world, working in the international field.

The various methods of remuneration of consulting engineers have already been described (page 13 et sig.) and do not in general require further elucidation. But, as the most usual method adopted for determination of fees is that based on percentage of cost, either estimated or actual, there are certain scales of fees recommended by the various associations of consulting engineers. The fees recommended by the British Association of Consulting Engineers and the American Institute of Consulting Engineers have been tabulated in the form of graphs. Further graphs have been estimated showing the various additions and deductions which may be made, according to the requirements of particular circumstances, to cover certain items which are regarded as extra to the basic fees or which may be deductible if certain services are not performed. The composite graphs are attached hereto as Appendices V, VI and VII, but here again it must be pointed out that circumstances vary and the graphs must be taken as a guide only. The following are examples of cases where the amount of work to be performed by the consulting engineer is not normal:

(a) The work is of an unusually complex or difficult character;

(b) The work is exceptionally large in extent or very simple in character, e.g., long tunnels, long lengths of roadwork, large dredging contracts, long lengths of large diameter trunk water mains or sewers;

(c) The works are to be carried out by direct labor, or partly by direct labor and partly by contract;

(d) The works are to be carried out by means of many separate contracts;

(e) The work comprises substantial alterations or additions to existing structures;

(f) The execution of the work is retarded in order to spread the costs over a number of years;

(g) The work is for a client of long standing who retains the same Consulting Engineer on a regular basis for the execution of the majority of his work;

(h) The work is to be carried out overseas in a remote area or under difficult or unusual conditions;

(i) The works are novel in character, and involve the use of experimental materials or techniques;

(j) The work includes a high proportion of buildings and building work;

(k) There is a large amount of reinforced concrete work and bar bending schedules are required;

(l) There is a large amount of structural steel work;

(m) The work requires a large amount of inspection work and witnessing of tests on plant and equipment;

(n) The engineers are required to assist in operation and management;

(o) The engineers are required to employ or use an excessive percentage of comparatively inexperienced local staff;

(p) The engineers are required to train local personnel.

In any of these cases, adjustments will be required in the recommended scales of fees. The graphs could, however, be used for comparison purposes when considering the suitability of fees proposed in any particular case, provided any special circumstances are taken into account when making the comparison.

APPENDIX I

SUPPLEMENTARY REPORT ON THE PLANS AND SPECIFICATIONS OF THE *** COMPANY FOR CONSTRUCTION OF WATER SYSTEMS IN ***

Relationship Between Client, Engineer and Contractor

In the construction of public water systems the client engages a consulting engineer to design such works in the event that their own engineering service is not adequate to carry on the work or sufficiently specialized. The client selects the consulting engineer not on a competitive bidding basis but on the basis of the engineer's reputation, technical ability, experience and availability to do the particular water supply study job. It is much the same procedure as an individual selecting a physician. One does not go out and secure competitive bids from various physicians to give one medical care, but selection is made upon the aforesaid qualities. The person selected should be one in which the client has implicit trust and confidence.

The consulting engineer, for a certain fee, then proceeds to make a preliminary study of the project in question, reviewing all possible solutions for obtaining a water supply or the best method for improving an existing water supply system. When these preliminary studies are completed a report is submitted to the client. The client then determines whether the project as proposed or recommended will be undertaken or postponed. In the event that it is decided to undertake the project, the engineer is then instructed to draw up detailed construction plans and specifications to carry out the project. When these detailed plans and specifications are completed it is customary to advertise for bids for construction by competent contractors who are skilled in water

supply construction. After the competitive bids are received the client makes a selection of the contractor with the advice of his consulting engineer. Usually the lowest bidding contractor is accepted if he is financially responsible and technically able to carry out the project. The contractor then proceeds with the construction of the project following in detail the construction plans and specifications under the supervision of the consulting engineer or his representative, the so-called resident engineer on the job.

If there are minor ambiguities in the specifications or contract, the consulting engineer is the arbitrator. However, in the event that the additional work is really beyond the scope of the specifications the contractor has the right to additional remuneration. This remuneration may ultimately have to be determined through legal processes in the courts. The equipment that is purchased for the construction project can either be purchased directly by the client or by the contractor. However, in all cases it must meet the specifications that have been set up by the client and his consulting engineer.

Thus, in a project of this type one has the client and his consulting engineer as one party to a contract and the contractor the second party. If the contracting, engineering and supplying of equipment are done by one party, it is considered unethical.

Specifications

In carrying out water supply construction work there are usually three major parts to a contract, the contract itself giving the terms and scope of the work, the conditions under which it is to be carried out and the payments to be made on the project and the necessary

performance bonds, penalties and bonuses to be paid for completion of the project.

The second part consists of detailed construction plans consisting of detailed drawings clearly showing the work to be performed by the contractor.

The third part of the so-called specifications gives in detail the kind of work to be done, the manner in which it should be done, the quality, quantity, kind and size of materials to be used.

The quality of materials to be used frequently designated by following some accepted standard, either international or, in many cases, American or British. These standards have been promulgated by careful professional study and research and usually accepted both by the engineering and industrial organizations. For example, in the United States specifications may be marked as follows:

ASTM - American Society of Testing Materials
AWWA - American Water Works Association
UL - Underwriters' Laboratory, Bureau of Standards, Department of Commerce

Frequently, instead of going into a detailed specification for each type of equipment, the specifications may state a certain catalogue number for a piece of equipment, specifying this catalogue number of a particular manufacturer or the substitution of equipment of another manufacturer with equal specifications. The specifications are prepared by the engineer as information to the contractor and it is upon the basis of the specifications that competitive bids are made by various contractors. The specifications should be in sufficient detail to insure a minimum of ambiguity so that the contractor knows exactly what the client

and engineer desire. Indefiniteness in specifications leads to controversy, delay and costly legal action.

For example, it is not sufficient to say in specifications a 12-inch valve. To illustrate this point I have taken from the Jenkins Manufacturing Company Valve Catalogue No.76 a list of 12-inch valves that could be utilized in water systems and meet the above indefinite specification. This list is appended to this document. You will note that there are 23 different valves varying in their list price from $125.00 to $425.00. Each one, however, has a definite use. In the event that the engineer did not specify the particular type of valve it would be natural for the contractor to put in the cheapest valve for, after all, he is in business to make money.

The same thing can be illustrated by having indefinite specifications for concrete work. For example, a 1:2:4 mix of concrete would require about six bags of cement per cubic yard of concrete, while a 1:4:8 mix would require less than three bags of cement per cubic yard of concrete. Therefore, unless the proper amounts are specified, there is a tendency for the contractor to use the leaner mixes with a consequent greater profit to himself, but possibly very damaging to the stability and safety of the structure.

The amount of water used in making a cubic yard of concrete is also very important. By using a larger amount of water one obtains concrete that is very nice in appearance but actually is not as strong structurally as concrete made with lesser amounts of water. Therefore, the water content of concrete must be specified.

Plans and Specifications for the *** Plant

I have reviewed the three volumes of the so-called plans and specifications prepared by the *** Company for the *** water filtration job. This job essentially consists of making an addition to the existing filtration plant and building a new water filtration plant together with a trunk line pipe connection.

These cannot be called truly contract drawings and specifications for construction. They certainly would not be clear enough for competitive bidding. Actually, they are more in the order of a description of the competentness of the *** Company, their experience and a proposal of what they can do for the city. They are simply a reflection of what happens when an equipment manufacturer, and I believe the *** Company could be considered a competent one, undertakes to do engineering, supply the equipment and do the construction of the job. Actually, it is a very unsound practice and I believe costly and not to the best interest of the client.

For example, in the report there are photographs of the *** plant which is apparently a filtration plant built by the *** Company. There are also photographs of *** plant and a photograph of the filtration plant in *** , although in the latter case the writer knows that this filtration plant was not designed by *** Company, which simply supplied the equipment.

One part of the report does include an engineering study of a portion of the distribution system of the city of ***. This, however, is customarily found in the preliminary engineering report on a project and not in the construction plans and specifications.

In general, the report could be considered more a description of the project, although there are certain facts and figures that do form a part of the normal specifications.

In regard to the adequacy of the report insofar as specifications are concerned, I might point out a few shortcomings. For example, for the electrical work on the project the report just states it should be of good quality. This is a very indefinite statement. It does not tell the location of the wires, their size, carrying capacity, whether they are to be located in pipe conduits or if BX cable is being used. Nothing is said of the type of fuse protection, the location of the switches, the outlets or lights.

In regard to valves, pipe, etc., no standards are set up for the quality of the material.

Apparently the report plans that the concrete work, excavation for pipes, etc., will be done by local sub-contractors. There is nothing in the specifications, however, to state the type of concrete to be used, the mixture, the water content, no provisions are made for testing and no standards set for testing the concrete so that a sub-contractor could not tell exactly what he was supposed to do.

In regard to the pipe-laying, nothing is said in the specifications as to the soil conditions, the manner in which the pipe shall be laid, the type of joint used or joining material used or the method of back-filling to prevent damage to the pipe. Nothing is said about tamping the soil around the pipe or no method of bracing the pipes at the ends is specified. The specifications do not specify the allowable leakage

in the pipe and no test is specified for determining leakage and whether the pipe and its joints will withstand the pressure necessary. Obviously, unless such underground pipe can withstand the pressures involved there will be a considerable amount of leakage which will be difficult to locate in the future and costly to the municipality if such leakage does occur.

In general, the plans and report would be very inadequate to permit competitive bidding by contractors.

LIST OF 12" VALVES TAKEN FROM JENKINS VALVES CATALOGUE No.76

Iron Body Gate - 125 lbs. steam at 450°F. 200 lbs. Non-shock Cold oil, water, gas.
Page 26 Solid wedge, inside screw, non-rising spindle
Fig. 325, 326 - Price: screwed $125.00 - Flanged $133.00

Iron Body Gate - 125 lbs. steam at 450°F. 200 lbs. Non-shock Cold oil, water, gas.
Page 28 Double-disc taper seat. Inside screw. Non-rising spindle.
Fig. 325 ½, 326½ Price: screwed $170.00 - Flanged $170.00.

Iron Body Gate - 125 lbs. steam at 450°F. 200 lbs. non-shock cold oil, water, gas.
Page 30 - Solid Wedge. Outside screw and yoke. Rising spindle.
Price: Screwed bronze spindle $172.00 - Flanged bronze spindle $180.00
Fig. 650,651 - Screwed steel spindle $160.00 - Flanged steel spindle $168.

Iron Body Gate - 125 lbs. steam press 450°F. - 200 lbs. non-shock cold oil, water, gas, press.
Page 32 Double disc - taper seat. Outside screw + yoke. Rising spindle
Fig. 650½, 651½ - Price: screwed $212.00 - Flanged $212.00

Iron Body Gate - 200 lbs. non-shock cold oil, water, gas. 400 lbs. hydrostatic test.
Page 34 Double disc. parallel seat. Inside screw. Non-rising spindle
Fig. 872, 873 - Price: Screwed $170.00 - Flanged $170.00

Iron Body Gate:- 200 lbs. non-shock cold oil, water, gas.
400 lbs. hydrostatic test.
Page 36 Double disc. parallel seat. outside screw + yoke. Rising spindle.
Fig. 874, 875. Price: screwed $212.00 - Flanged $212.00

Iron Body Gate: 175 lbs. steam at 450°F. - 400 lbs., non-shock cold oil, water, gas.
Page 40 Solid wedge. Inside screw. Non-rising spindle.
Fig. 251, 255 - Price: screwed $185.00 - Flanged $195.00

Iron Body Gate: 175 lbs. steam at 450°F. - 400 lbs. non-shock cold oil, water, gas.
Page 42 Solid Wedge. Outside Screw + yoke. Rising spindle.
Fig. 277, 253 - Price: Screwed bronze spindle $227.00 - Flanged bronze spindle $237.00 - Screwed steel spindle $215.00 - Flanged steel spindle $225.00.

(List continues for two more full pages.)

Competitive bidding for professional services not in the public interest

Nor required by law, courts hold

WILLIAM N. CAREY, M. ASCE, Executive Secretary, ASCE, New York, N. Y.

Recent actions by the commissioners of the highway departments in at least two of our states have served to put an important question squarely up to the engineering profession at least to its civil engineering segment. The question appears to me to resolve itself into whether civil engineer consultants, and civil engineer state and local officials, should abandon their long-held contention that engineering is a profession.

Two state highway departments recently have invited competitive bids from engineers for the furnishing of professional engineering services on certain state highway projects. In each case it was provided that sealed bids or proposals would be received up to a certain date, then opened and reviewed.

Either a bid form or a form of a final contract was furnished by the state, and each engineer was invited to insert in the form his price for furnishing the services outlined. In each case the usual escape clause, generally of no practical effect unless all bids are rejected, was included. It is that the owner reserves the "right to reject any or all bids." It is on this slender thread that some public officials and some engineers base a contention that bids or proposals received are not necessarily judged on a price basis, and therefore, that the procedure does not violate the ASCE Code of Ethics.

Both engineers and public officials know full well that the only purpose of receiving sealed proposals or bids of the kind here discussed is to facilitate a decision based on price, no matter what pious denials may be made. There have been occasions where public officials, even attorneys for public bodies, have been under the misunderstanding that their public works laws or ordinances compel competitive bidding on all contracts concerned with public works. A typical clause in public works laws follows:

> "Every contract or purchase made by the State Highway Department which contemplates the expenditure of more than $1,000.00, shall be let and made after being advertised under rules and regulations to be made and published by the Department."

Under the clause above quoted or some similar provision, public officials sometimes feel they must obtain competitive bids for professional engineering services. Oddly enough, if outside legal consultation is required by these same public officials connected with the same public works project, one never hears that they attempt to engage such consulting legal services through competitive bidding practices. They recognize the law as a profession and they conform to proper professional procedures. They seem unaware that engineering also is a profession. The courts, however, have clearly held that it is.

Not required by law

A good example of how the courts look at competitive bidding safeguards in public works laws and ordinances when professional services are concerned is indicated in an opinion by the Supreme Court of the State of California in the case of Clyde C. Kennedy vs Harry D. Ross, Controller of the City and County of San Francisco. The opinion is identified as "S.F. No. 17,298." In the San Francisco case it was alleged that certain engineering services for the city should have been contracted for after receipt of competitive bids because of the city ordinance requiring competitive bids for things and services costing over a certain sum.

The city engineer's office engaged the engineer under proper professional procedures but the controller refused payment on the grounds that the city ordinance had not been followed. The controversy was carried to the Supreme Court of the State of California. Some of the pertinent phrases in the opinion handed down are quoted below.

While pointing out that the City Charter went to great pains to require that contracts for the *construction* of public works should be subject to competitive bidding, the Court noted that it "does not follow that strict compliance with that requirement must be maintained in procuring expert services to furnish plans and specifications for the construction."

In citing the decision on another case (Los Angeles Dredging Co. vs Long Beach, supra 210 Cal.), the same California Supreme Court stated that "it was recognized that there are exceptions to the requirement

gence and ability to be elected or appointed could be so naive as to believe it could possibly be in the public interest to make contracts for professional services on the basis of competitive bidding. As stated in the Miller vs Boyle California case, it is beyond peradventure that the lowest bidder might be the least capable and most inexperienced. Or, as in Stephens vs McCammon, where the Texas Supreme Court stated, "to construe the statute contended for (competitive bidding for a professional service contract) would place a premium upon incompetency."

It should be clear that the best engineering service obtainable on an engineering project assures the public of the best results. "Best results" means the best design and construction for the purpose at the least cost. The cost of the engineering service for a project is a very small part of its total cost, perhaps but 4 to 8 per cent of the total. The difference between the cost of construction of a project which is even tinged with bad design or unsound engineering judgment and the contract price for constructing a well designed project can easily amount to several times the engineering fee. Cheap design always means high construction costs.

There are unscrupulous men in the engineering profession as there are in medicine and in law. Our professional licensing laws only partly protect the public from these shoddy characters. Professional codes of ethics in these fields and the manner in which the practitioners of these professions conform or fail to conform to these codes usually serve to set the truly professional men apart from the unethical. In the Code of Ethics of the American Society of Civil Engineers, it is stated that "It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of the American Society of Civil Engineers . . . to participate in competitive bidding on a price basis to procure a professional engagement." This clause does not purport to prohibit competition among engineers nor is there any intent or attempt in our sister professions to prohibit competition among lawyers or doctors. All clearly prohibit competition on a *price* basis, and properly so in the public interest, as has been indicated. Any member of ASCE convicted of violating its Code of Ethics is subject to discipline, even expulsion from the Society, a very serious matter to any truly professional man.

Negotiate with qualified engineers

Competitive bidding is not the way to obtain engineering services. It is practically never adopted by industry, and when adopted by any agency of government, it is usually through ignorance on the part of the governmental unit concerned. The Federal Government is the largest single spender of money for public works, and the Congress is ever alert to provide laws to safeguard the expenditure of public works funds. The Defense Department probably spends most of the federal funds. Regulations of the Defense Department provide that engineering and architectural services shall be procured by negotiation; not through any attempt at competitive bidding. The basic clause in this regulation follows:

"The selection of architectural and engineering firms for the preparation of plans and specifications for public works or for other similar technical and professional services, such as master planning, engineering studies, and investigations, will not be based upon competitive bidding procedures but solely upon the professional qualifications necessary for the satisfactory performance of the services required."

This same principle is followed by the Atomic Energy Commission, the Department of the Interior and its Bureau of Reclamation. The General Services Administration which supervises many other public contracts [ ] the government adheres to this same principle as do most other units of government, state and local.

The detailed procedure recommended by ASCE through which any client should engage professional engineering services is set forth on page 5 of the ASCE Manual of Professional Practice, Manual No. 29. For ready reference, this recommended procedure is quoted below:

"1. From a list of engineers recommended by qualified sources such as other employers or engineering societies, select one or more engineers to be interviewed.

2. Determine which one of the engineers interviewed is best qualified for the particular engagement under consideration.

3. Negotiate with the engineers so selected for services of the nature and extent required.

4. The reasonableness of fees to be charged may be checked with sources of the information considered under "1" above.

5. Engagements involving preliminary investigation and reports should commit the engineer to limiting fees in case additional engineering services are required at a later date on the same project."

This is a clear cut statement of how negotiation should be carried out. Obviously, if the client and the engineer cannot negotiate an agreement as to factors of time, personnel, price or for any other reason, the attempt will be abandoned and the client will negotiate with another qualified engineer. It is not intended or implied that ASCE recommends that it is in the public interest that the factor of price be *neglected* in such negotiations. It is to be emphasized, however, that the cost of engineering service is but one factor, and a minor one, in the total cost of the project involved. Qualifications other than direct cost of engineering should carry most of the weight in negotiations for professional services.

Points against competitive bidding summarized

The procurement of professional engineering services for public work through negotiation, rather than by attempting competitive bidding procedures, has been pronounced by the courts as being in accordance with our laws. The courts have gone farther and have pointed out that attempts by public agencies to obtain professional services through competitive bidding are not in the public interest. The principal agencies of the Federal Government through which billions of public funds are expended on public works every year, procure professional services through negotiation. State and local governments follow federal practice with rare exceptions.

So-called professional engineering services by licensed engineers sometimes can be procured through competitive bidding. In the rare cases where this practice is resorted to, trouble usually follows. High construction costs follow cheap design—always. In spite of high construction costs, cheap design and its natural companion, bad engineering judgment, may well result in project failure after construction.

Professional codes of ethics exist for two main reasons. One is to furnish a way to warn the public from involvement with professional sharpers or worse. The other is to state fundamental principles of ethics and practice for the conduct of individuals within the profession. The ASCE Code of Ethics prohibits competition *on a price basis*. Public works laws and ordinances do not require competitive bidding on professional service engagements. Public interest is served best when needed professional services are secured through negotiation with qualified professional people who conduct themselves in accordance with their accepted codes of ethics and practice.

COPY

APPENDIX III

MINISTRY OF TRANSPORT AND WORKS

Trans works House
P.O.Box 547
Colombo

12th December, 1955

Gentlemen,

Ceylon Aberdeen-Laksapana Hydro-Electric Scheme - Stage 11B

The Government of Ceylon desires to embark, as early as possible, on what is known as Stage 11B of the Aberdeen - Laksapana Hydro-Electric Scheme. I annex a Report by Messrs. Preece, Cardew & Rider of Queen Anne's Gate, Westminster, S.W.1, London, U.K., Engineering Consultants dealing with this stage of development.

2. The Ministry of Transport and Works is not committed to the acceptance of the design of the scheme prepared by Messrs. Preece, Cardew & Rider and desires to examine the merits of any alternative scheme which Constructing firms, who are interested in undertaking the project, may wish to suggest.

3. I am writing to you on the subject as you would probably desire to have the opportunity of offering your services as Contractors for the execution of the work.

4. The precise manner of proceeding with the scheme has not yet been decided. It will be noted that the scheme, as presently designed, calls for a $4\frac{1}{2}$-mile tunnel. The question, for instance, whether the alternative of an open flume to convey the water would be cheaper in cost and is technically sound having regard to the topography of the country and the risk of land slides, in view of the high rainfall averaging 220 inches a year, is a matter which would, of course, require close investigation.

5. I shall be glad if you will scrutinise the Report and inform me

(i) whether any fundamental changes in the design of the scheme for Stage 11B to develop 50 M.W. of electrical power merits examination;

(ii) if so, the nature of such change and what fee, if any, you would charge for a preliminary report with estimate of cost of the work, after inspection of the site, if necessary;

(iii) how long it would take you:

(a) to furnish the report; and

(b) to prepare detailed plans and specifications and tender for the execution of the entire work on the basis of the scheme prepared by you;

(iv) in the event of the basic design prepared by Messrs. Preece, Cardew & Rider being considered the most economical, whether you would offer to prepare, without cost, detailed plans and specifications and tender for the execution of the work; and

(v) how long it would take you to furnish the data and quotations specified in (iv) above.

6. The construction work will be supervised by the Department of Government Electrical Undertakings and a firm of Consultants selected by the Ceylon Government.

7. I should be grateful if you would send me as early as is possible a reply.

Yours faithfully,

Permanent Secretary,
Ministry of Transport & Works

APPENDIX IV

MODEL FORM OF AGREEMENT

Agreement Between a Client and Consulting Engineers for the Design and Supervision of

WORKS OF CIVIL ENGINEERING CONSTRUCTION

MEMORANDUM OF AGREEMENT, made the day of One thousand nine hundred and BETWEEN (Name and address)

(hereinafter called "the Client") of the one part (names) practising as Consulting Engineers at (address) under the style of (name of firm) (who and the survivors or survivor of whom are hereinafter called "the Consulting Engineers") of the other part.

WHEREAS the Client has considered and approved the proposals recommended in a report submitted by the Consulting Engineers, now intends to proceed with the construction of (here describe briefly the proposed work)(hereinafter called "the Works") and has requested the Consulting Engineers to undertake and perform the duties hereinafter mentioned which the Consulting Engineers have agreed to do upon and subject to the terms and conditions hereinafter set forth.

NOW THESE PRESENTS WITNESS and it is hereby agreed and declared by and between the parties hereto as follows:

1. Appointment of Consulting Engineers. The Client hereby appoints the Consulting Engineers and the Consulting Engineers accept the appointment on the terms and conditions hereinafter set forth.

2. Duties of Consulting Engineers. The duties to be performed by the Consulting Engineers are:

A. The preparation in outline of such drawings, estimates and other engineering documents as are necessary to enable the proposals for the construction of the Works to be submitted for preliminary approval by the Client or by the appropriate Government Department or Public Authority, including as may be necessary in the particular case:

(a) A survey or surveys of the site.
(b) Investigation of available data or information relating to the Works.
(c) Advice to the Client as to the necessity for special investigations of conditions of sub-soil, tide or weather and arranging on the Client's behalf for boring tests, trial pits, test piling, models or other investigations as may be agreed to be necessary.

(d) Consultation with any architect appointed by the Client in regard to the architectural treatment of the Works.
(e) The making of such modifications in the outline drawings and estimates of the Works in connection with the consultations aforesaid as may be approved by the Client.

B. The preparation of the drawings and engineering documents necessary for seeking the formal approval of the appropriate Government Department or Public Authority to the construction of the Works and the preparation of all drawings and other documents to enable the Works to be tendered for or otherwise ordered by the Client, including as may be necessary in the particular case:

(a) The making of designs, drawings, specifications and preparing schedules or bills of quantities.
(b) The making or adapting of conditions of contract, forms of tender and invitations to tender and submitting the same for approval and decision of the Client.
(c) Advising the Client as to tenders, tenderers, prices and estimates for the carrying out of the Works provided that no tender shall be accepted or order be placed by the Consulting Engineers except on behalf of the Client and with his authority in writing.

C. The general supervision of and other services in connection with the carrying out of the Works, including as may be necessary in the particular case:

(a) Advising as to the preparation of the contract relating to accepted tenders.
(b) Preparing any further plans, designs and drawings necessary for the carrying out of the Works.
(c) Examining and approving Contractors' details.
(d) Making arrangements on behalf of the Client for the inspection and testing during manufacture of such materials and plant as are usually inspected and tested.
(e) Issuing instructions to Contractors and generally supervising the execution of the Works, including such site visits as the Consulting Engineers consider necessary.
(f) Issuing all certificates for payments to Contractors.
(g) Supervising acceptance tests on site.
(h) Assisting in settling disputes or differences that may arise between the Client and Contractors excepting litigation and arbitration.
(i) Providing the Client on completion of the Works with such record drawings as are necessary for operation and maintenance.

3. Remuneration of Consulting Engineers. The remuneration of the Consulting Engineers for the performance of the necessary services under Clauses 2A, B and C of this agreement shall be calculated as a fee on the basis and in the manner set out in Part I of the Schedule hereto and shall become due to the Consulting Engineers (subject to any special arrangements for interim payments) as follows:

(a) Two-tenths of the fee shall become due when such duties as may be necessary under Clause 2A have been completed.
(b) A further five-tenths of the fee together with the whole of the additional percentage fee for the design of structural steelwork and reinforced concrete shall become due when such duties as may be necessary under Clause 2B have been completed.
(c) The remaining three-tenths of the fee shall become due as and when the work proceeds in proportion to the value of the work certified.

Provided that if the Consulting Engineers shall prepare the contract plans, designs and drawings, in addition to the services under Clause 2A, then one-half of the fee shall become due under sub paragraph (a) and two-tenths of the fee shall become due under sub paragraph (b).

Payments or intermediate payments under this clause shall be calculated on the cost of the accepted tender, or if no such tender has been received, on the best estimate of the cost of the Works at the time payments become due. Such payments or intermediate payments shall rank solely as payments on account towards the total fee ultimately payable and calculated on the Cost of the Works, as defined in Clause 6.

Where fees are based upon the time occupied, the Consulting Engineers shall be paid for work done by themselves and by their technical assistants at the rates shown in Part II of the Schedule hereto.

Payments on account shall be made in such amounts and on such dates as may from time to time be agreed. The final payment shall be made within three months of the completion of the work; should the Contractor's account of the work not be completed by then, payment shall be made on the best estimate of the cost at the expiration of three months after completion, any adjustment necessary being made when the accounts have been completed.

4. Additional Duties. Should the Client require the Consulting Engineers to undertake additional duties such as advising or assisting in connection with:

(a) Obtaining Parliamentary Powers or Ministerial Orders.
(b) Departmental Enquiries not directly concerned with the Works.
(c) The valuation, purchase, sale or leasing of lands or the obtaining of wayleaves.
(d) The making of such revisions as may be required to obtain the formal approval of the appropriate Government Department or Public Authority.
(e) Obtaining formal consents by outside Authorities or persons having rights or powers in connection with the Works or the site thereof.
(f) The making of special or extensive surveys.

(g) Supervising and reporting on model tests or special investigations on sub-soil, tide, weather, etc.
(h) Preparing and setting out details and calculations in a form suitable for submission to any appropriate authority.
(i) Preparing shop details for steel work.
(j) The failure of any Contractor to perform his contract.
(k) Arbitration or other legal proceedings.

then the Consulting Engineers shall undertake such duties on terms and conditions to be agreed between the parties.

5. Out-of-pocket Expenses. In addition to the remuneration to be paid under this agreement the Consulting Engineers shall be reimbursed by the Client all out-of-pocket expenses actually and properly incurred by them in connection with the Works in respect of:

(a) Printing, reproduction and purchase of all documents, drawings, maps and records.
(b) Fees for special professional advice and laboratory investigations as may be obtained by arrangement with the Client.
(c) Telegrams and telephone calls other than local.
(d) Travelling and hotel expenses and other similar disbursements.
(e) Advertising for tenders and for resident site staff, provided that the Consulting Engineers and the Client may agree on an increase in the scale of fee to cover any or all of the expenses under (a) to (e) above.

6. Cost of Works. A. For the purpose of ascertaining the remuneration to be paid under Clause 3 hereof the Cost of the Works or any part thereof shall be deemed to include:

(a) The amount certified to the Contractor, or the amount certified as cost of Works if carried out by direct labor, of Works designed, specified or supervised by the Consulting Engineers, before deduction of liquidated damages or penalties (if any).
(b) A fair valuation of any labor, materials, manufactured goods or machinery, provided by the Client and of the use and waste (including all cost of repairs) of constructional plant and equipment belonging to the Client which he shall require to be used in the carrying out of the Works.
(c) The market value as though they were purchased new, of any second-hand materials, manufactured goods and machinery incorporated in the Works.

B. The Cost of the Works shall not include the following items:

(d) Administrative expenses incurred by the Client.
(e) Payments made to the Consulting Engineers.
(f) Salaries, travelling, out-of-pocket and office expenses of resident site staff.

(g) Interest on capital during construction and the cost of raising moneys required for carrying out the construction of the Works.
(h) Cost of land and wayleaves.

7. Supervision on Site. The Consulting Engineers shall, subject to the approval of the Client which shall not be unreasonably withheld, appoint such resident site staff as is necessary for the efficient supervision of work on site or alternatively shall nominate such staff for appointment by the Client. In either case, such staff shall take instructions from the Consulting Engineers only. The salaries, allowances, travelling, office and out-of-pocket expenses of such staff shall be paid by the Client or if mutually agreed by the Consulting Engineers, but if paid by the Consulting Engineers such payments shall be refunded to them monthly by the Client. The Client shall provide such local office accommodation, furniture, equipment and transport as shall be reasonably necessary for the use of the resident staff. In the event of the Consulting Engineers, with the approval of the Client, not appointing a full-time resident staff for the supervision of the work on site, they shall be entitled to charge for any necessary additional services rendered by themselves and their assistants on a time basis calculated in accordance with the scale in Part II of the Schedule hereto.

8. Damage or Destruction of Works. If at any time before the completion of the Works any part of the Works or the equipment therefor shall be damaged or destroyed by operations of war or other cause, the Client shall pay to the Consulting Engineers the appropriate fee for any additional work which may be required to be designed and supervised by them as a result of such damage or destruction.

9. Postponement, Cancellation or Abandonment of Works. In the event of the whole or any part of the Works being postponed, cancelled or abandoned then the payment to be made to the Consulting Engineers for services performed in respect of that part of the Works so postponed, cancelled or abandoned shall be determined in accordance with Clauses 3, 4, 5 and such other Clauses of this Agreement as may be applicable thereto (with such appropriate adjustments as may be necessary having regard to the services performed prior to the Works being so postponed, cancelled or abandoned). Payments under this Clause shall be calculated on the best estimate of the value of the relevant part of the Works had it been completed at the time of its postponement, cancellation or abandonment. If, at a later date, the Works which have been postponed, cancelled or abandoned or any part thereof are again proceeded with, any payments made under this Clause shall rank solely as payments on account towards the total fee ultimately payable on such Works and calculated on their actual cost. If the whole or any part of the Works is postponed and additional services by the Consulting Engineers are necessary in connection with the resumption of such Works, a fee additional to the amounts payable under Clauses 3,4,5 and other Clauses hereof shall be due, the fee being on a time basis in accordance with the scale shown in the Schedule hereto.

10. Alterations or Modifications to Designs. In the event of circumstances arising which could not have been reasonably foreseen, or in the event of the Client ordering modifications to completed designs or alterations to designs in progress, which require the alteration or remaking of any specification, drawings or other documents prepared in whole or in part by the Consulting Engineers, the whole of the cost of revising, amending or reproducing documents to bring the work up to the stage at which it was modified shall be the subject of additional payment, computed on a time basis in accordance with the scale shown in the Schedule hereto, together with any out-of-pocket expenses incurred.

11. Care and Diligence. The Consulting Engineers shall exercise all reasonable skill, care and diligence in the discharge of the duties agreed to be performed by them and in so far as any of their duties are discretionary shall act fairly as between the Client and the Contractor or Contractors. The Consulting Engineers shall have authority to make minor alterations to design involving minor variations to cost as may be necessary or expedient, but they shall obtain the prior approval of the Client to any substantial modification of the design and cost of the Works and to any instruction to a Contractor which constitutes a substantial variation, omission or addition to the contract.

12. Data to be Supplied to Consulting Engineers. The Client shall furnish all pertinent data and information and give such assistance as shall reasonably be required for the carrying out by the Consulting Engineers of their duties under this Agreement and the Consulting Engineers and the Client shall use all reasonable expedition and despatch in carrying out the provisions of this Agreement.

13. Ownership of Documents and Copyright. All documents prepared by the Consulting Engineers in connection with the Works are the property and copyright of the Consulting Engineers subject to their use by the Client for the particular Works to which this Agreement relates, and the Client shall not be entitled, either directly or indirectly, to make use of such documents for the carrying out of any additional or similar work.

14. Publicity Relating to the Works. In cases where notice or display boards are erected on the site, the Consulting Engineers shall have the right, if they so elect, to have their name, designation and address inscribed on such boards, and to have their name and designation included when commemorative tablets or stones are provided in the finished structure. The Consulting Engineers shall also have the right, subject to the Client's approval, to publish descriptive articles with or without illustrations, relevant to the Works, either on their own account or in conjunction with other parties concerned.

15. Non-assignment. The Consulting Engineers shall not have the right to assign or transfer the benefit and obligations of this Agreement or any part thereof and the same shall automatically come to an end on the death of the survivor of them but without prejudice to the accrued rights of either party against the other under this Agreement provided, however, that it shall be lawful for the Consulting Engineers at any time to take

into partnership another Partner or Partners and that he or they shall thence be deemed to be included in the expression "the Consulting Engineers" where the context so allows or permits.

16. Arbitration. Any dispute or difference arising out of this Agreement shall be referred under the provisions of the Arbitration Act, (.....) or any statutory modifications or re-enactment thereof for the time being in force to the arbitration of a person to be mutually agreed upon or, failing agreement, of some person appointed by the President for the time being of the Institution of (name) Engineers of (country).

IN WITNESS whereof, etc.

SCHEDULE

PART I

Basis of Remuneration

The scale of charges shall be on the basis of....

PART II

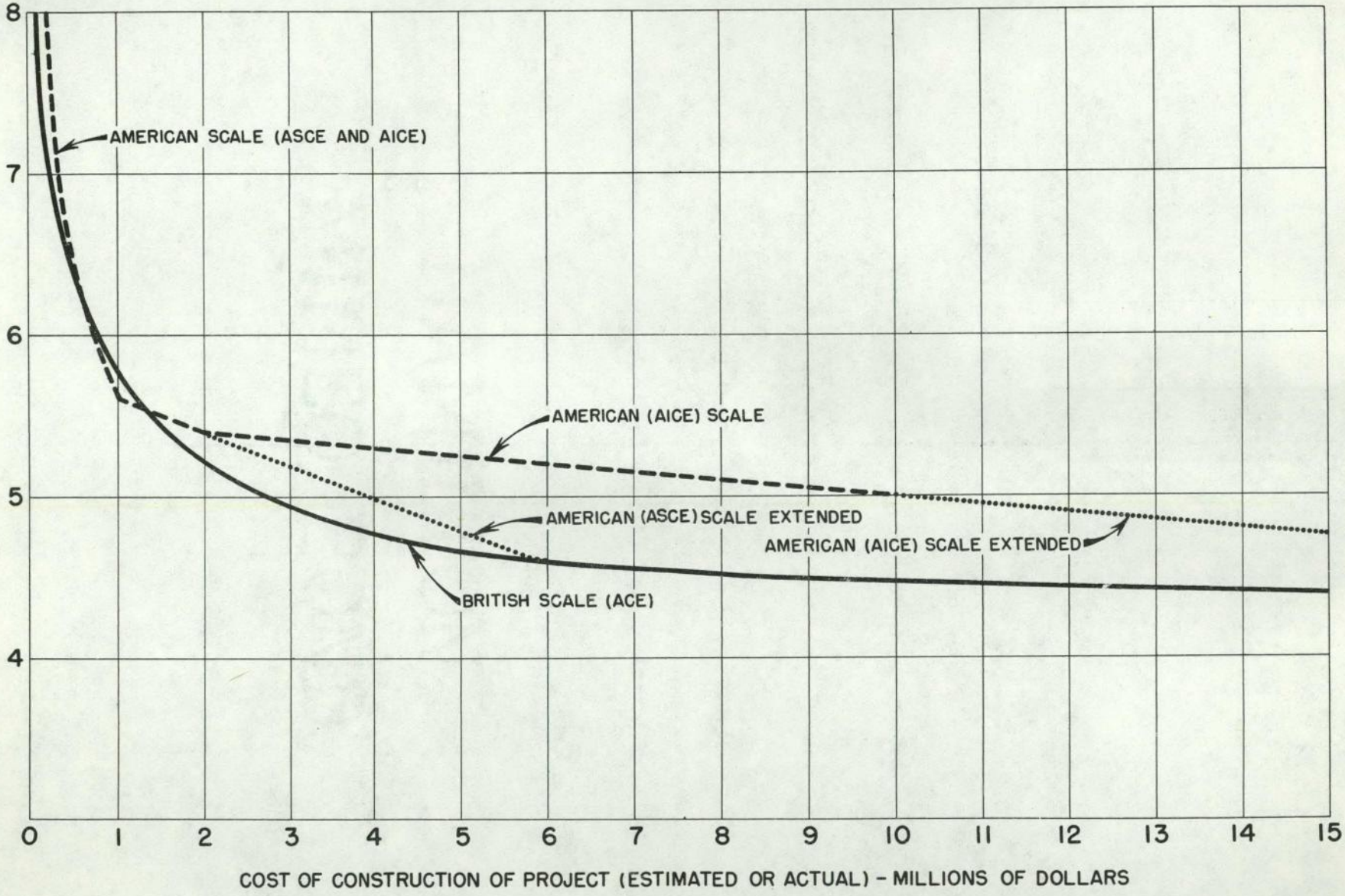
Hourly and Daily Rates

The scale of charges on a time basis shall be as follows:

Time expended by clerical staff (unless otherwise agreed) shall not be chargeable.

Time spent by Partners, Directors and Technical Staff in travelling shall be chargeable.

COMPARISON OF AMERICAN AND BRITISH SCALES



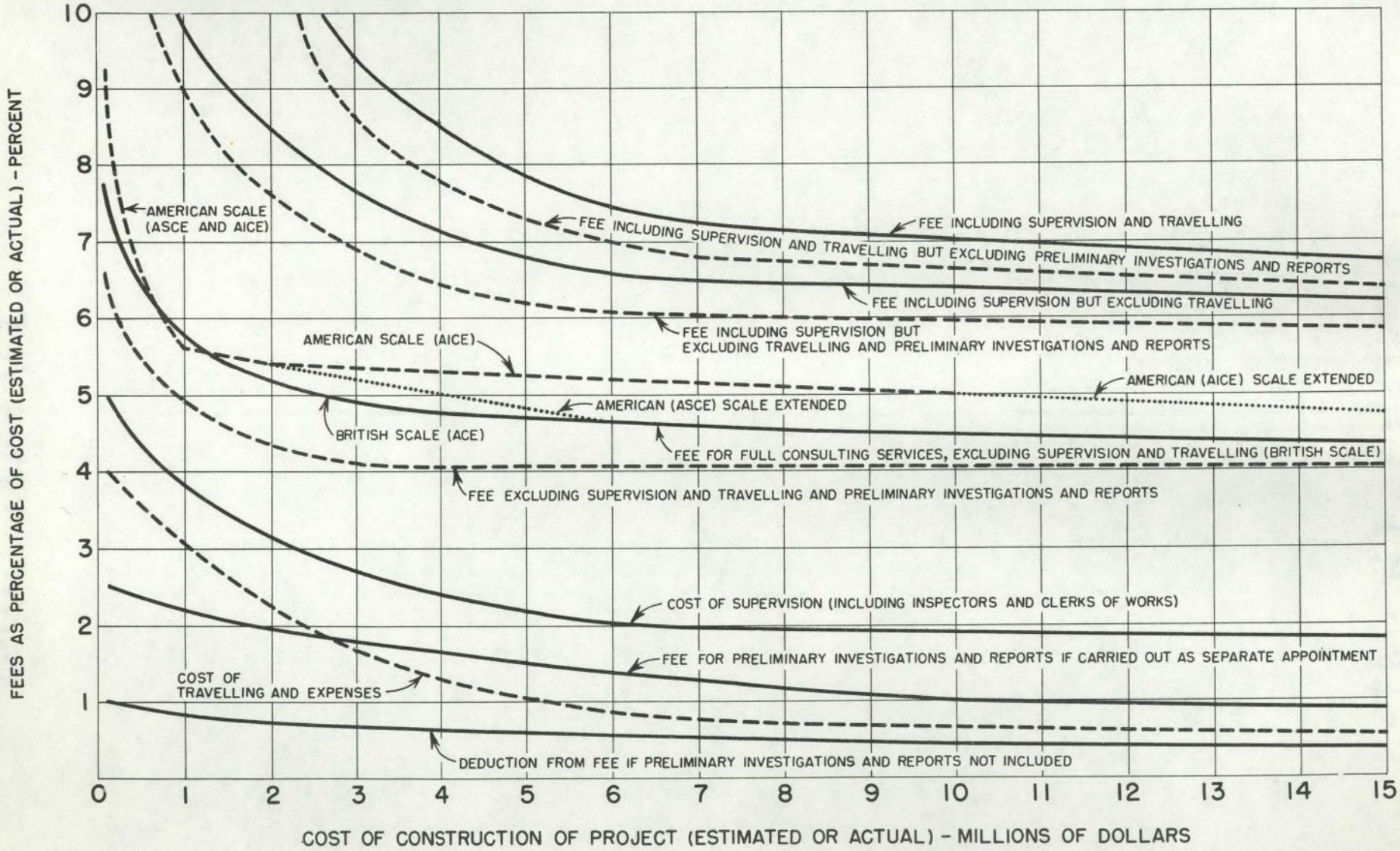
IBRD - Economic Staff

1174

APPENDIX V

ESTIMATED SCALES OF FEES, $ 100,000 - $ 15,000,000

(BASED ON BRITISH SCALE)



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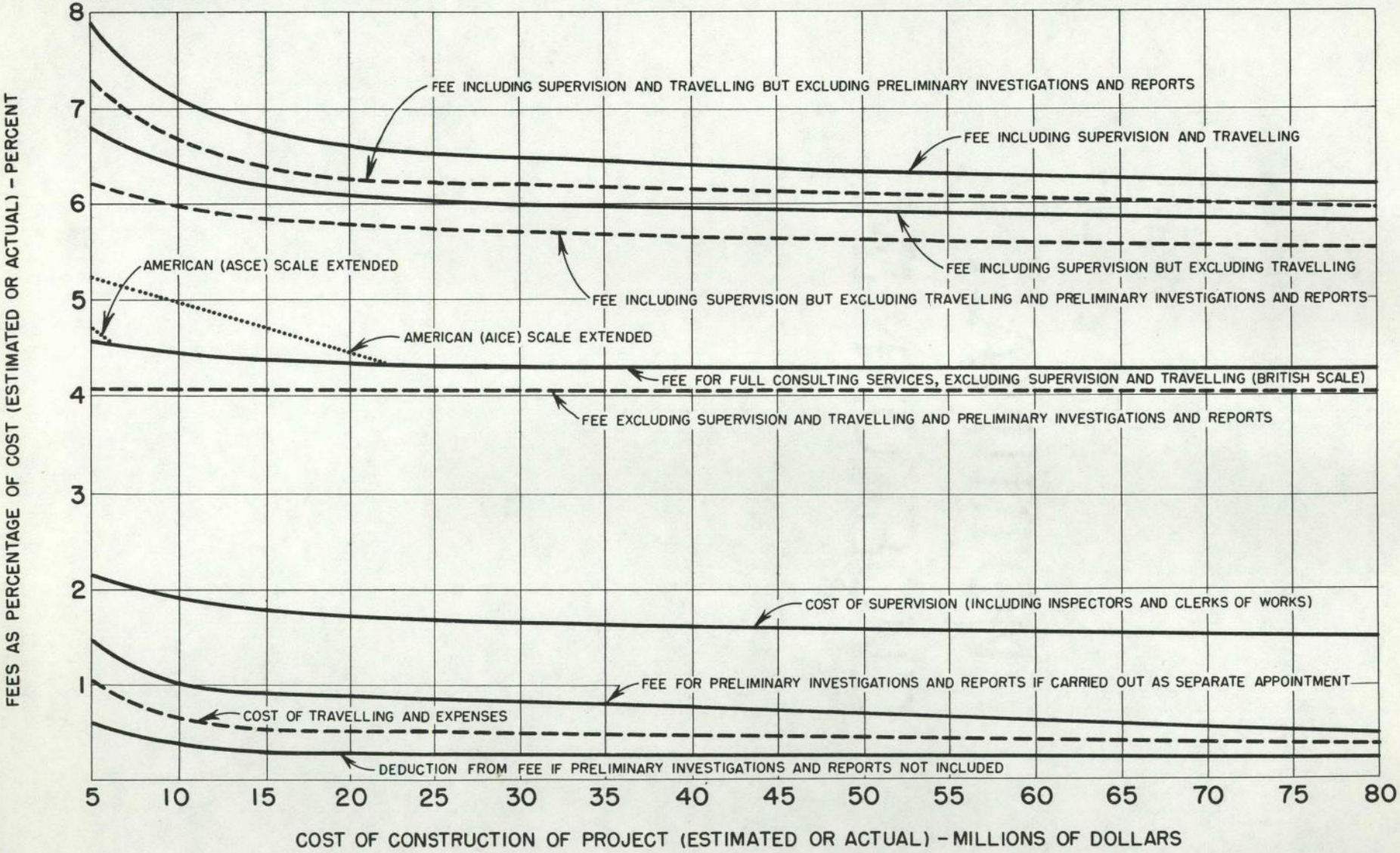
1175

APPENDIX VI

ESTIMATED SCALES OF FEES, $ 5,000,000 - $ 80,000,000

(BASED ON BRITISH SCALE)



IBRD - Economic Staff

(R)1176

APPENDIX VII

Mr. Colquhoun report

Report on consultants received back from:

Messrs. Jenkins (3)
Iliff
Woolley
Oppenheimer
Broches
Sommers
Demuth
Clark
Rist
Allardice
Rosen
Beach

14

Print Shop (1)

(1 — Mr. Woolley — for Mr. Iliff)

Bothenstein has 1 with him

(4 Missing)

All returned to Mr. Woolley for changing cover — + correcting pages =
Sept 24 - 1956.
R-

Not to be Treated
As a Bank
report per
M. Hamilton.
16 - Sept 6.58

852

This report is not to be published nor may it be quoted as representing the Bank's views.

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

BACKGROUND TO PROCEDURE ON EMPLOYMENT OF CONSULTING ENGINEERS

Prepared by:
Brian H. Colquhoun
Engineering Adviser

CONSULTING ENGINEERS

(I) Bank's Interest in Consulting Engineers

The Bank's operations and activities are concerned with consulting engineers in the following ways:

1. Consulting engineers employed by the Bank to assist in -
   a. Project appraisal
   b. End use supervision
2. Consulting engineers employed jointly by the Bank and a member country;
3. Consulting engineers employed by borrowers for -
   a. Preliminary investigations and project reports
   b. Design and supervision of projects
4. Consulting engineers employed in member countries in connection with operations not financed by the Bank.

(II) Different Types of Consulting Engineers

Consulting engineers may, in general, be divided into the following categories:

A. Firms of professional consulting engineers

B. Firms of consulting engineers who also undertake functions performed by contractors

C. Firms of consulting engineers associated with or owned by contractors or manufacturers

D. Contractors with design offices which offer services as consulting engineers

E. Manufacturers of specialized plant with design offices which offer services as consulting engineers

F. Commercial operating organizations or nationalized industries undertaking work as consulting engineers.

Firms in Category (A) are in general nearly always members of the various Associations of Consulting Engineers in the countries of which they are based. All these Associations define a consulting engineer as a person possessing the necessary qualifications to practise in one or more of the various branches of engineering, who devotes himself to advising the public on engineering matters or to designing and supervising the construction of engineering works and for such purposes occupies and employs his own office and staff, either solely or in conjunction with another consulting engineer and is not directly or indirectly concerned or interested in commercial or manufacturing interests such as would tend to influence his exercise of independent professional judgement in the matters upon which he advises. The first and primary duty of the consulting engineer is to safeguard the interest of the client and to ensure a sound engineering job at minimum cost. Long experience has shown that this can only be achieved if the contractor as well as the client has confidence in the impartiality and fairness of those responsible for the design and supervision of the job. There are two risks to guard against, - first, actions by the contractor to the detriment of the client, such as excessive costs or inferior work, and secondly, though not so common, unfair treatment of the contractor by the client, such as failure to pay legitimate claims or the issuing of unwise, misleading or contradictory instructions. Where the relations between the client and contractor become unsatisfactory for any of the reasons mentioned above, the job is bound to suffer and in the long run

the client is the loser. It is to avoid such difficulties that there has been evolved gradually the client-consultant-contractor relationship which long experience has proved to be extremely effective. In this relationship, the consulting engineer stands between client and contractor and ensures efficient and fair treatment of both parties, as well as providing the best possible engineering advice. A consulting engineer, therefore, is one who, through special training, broad experience, proven ability and professional integrity, brings to his client technical advice of the highest quality in the fields where he practises as an expert. In all matters under the terms of reference of his appointment, he acts as the client's representative and carries out the project to the best of his ability and in the best interests of his client. Firms of consulting engineers with these high ethical standards are not and cannot always be employed for any particular project and consulting engineers in the other categories listed above may be used. Firms in Category (B) are mostly professional consulting engineers who, however, undertake functions which would not permit them to be members of one of the Associations of Consulting Engineers. Frequently they are firms of high ethical standards and can generally be regarded as being as suitable as firms in Category (A), so long as their individual limitations are recognized.

Consulting engineers under Categories (C), (D) and (E) are not independent and free, and are usually more concerned with their shareholders than their client. They have in fact to effect a compromise between the best interests of their shareholders and the best interests of their client in an effort to keep both satisfied. In general, the only effective way for a client to safeguard his own interests in employing Categories (C) and (D) as consulting engineers is to stipulate at the commencement

that, if acting as consulting engineers, they will not be permitted to tender subsequently for the construction work. Such a condition would also in general apply to Category (E) but cases arise in which firms under this category are the only possible designers of some specific type of plant or equipment. In such cases, where a specialized manufacturer, acting as consulting engineer for a project, is also to supply plant and equipment or to be permitted to tender for plant and equipment, some safeguard can be obtained by having the project checked or supervised by an independent consulting engineer who still may not be capable himself of carrying out the complete specialized designs. An excellent example of the dangers of using classifications (D) and (E) as consulting engineers has recently come to light in the case of a country which permitted a firm of manufacturers to act as consulting engineers for the designs and preparation of specifications for a water supply project. As a result of certain complaints, an independent consulting engineer was brought in to report on the plans and specifications which had been drawn up. A copy of this report is attached hereto as Appendix I.

Category (F) is self-explanatory and such organizations are usually confined to surveys and project appraisals. It is unusual and usually unsatisfactory to a client for such organizations to be used for complete design and supervision of a project.

(III) Selection of Consulting Engineers

Consulting engineering firms who are members of the professional Associations of Consulting Engineers are prevented by the rules of their Association from knowingly entering into competition for selection of consulting engineers on a competitive price basis. Such price competition is also expressly forbidden in most of the national professional institutions

of engineers such as the American Society of Civil Engineers and the Institution of Civil Engineers of England. It is not only wrong professionally but is not in the best interests of the client. This concept is well set out in an article by William Carey, until recently Executive Secretary of the American Society of Civil Engineers. This article appeared in the May 1954 issue of "Civil Engineering" and a copy is attached hereto as Appendix II. Competitive bidding for professional services on a fee basis places a premium on inefficiency and incompetency. Cheap design nearly always means high construction costs. This does not mean that price of engineering services should be neglected in negotiations for the selection of a consulting engineer but qualifications other than the cost of fees should carry most of the weight in selection of professional services. In making inquiries from consulting engineering firms, therefore, for their possible use for professional services, certain questions should be asked and the answers to these questions should form the main basis in the selection of consulting engineers, rather than the fees which they may require for undertaking the work. There are a number of questions which in general should always be asked in considering the selection of a firm of consulting engineers:

1. What are the qualifications of the firm for undertaking the project in question?
2. What classes of work have they undertaken in the past?
3. What size staff do they employ and what volume of work have they on hand at the time in question?
4. In what countries have they worked?
5. What staff would they propose to assign to the present project?
6. What are the qualifications of each of the staff?
7. How would they propose to tackle the job?

8. What would be their time schedule for the work contemplated?

9. What items of work or investigation would they cover?

10. Lastly, - what fees would they charge?

On the basis of the answers to all these questions, the selected consulting engineer should be required by the client to present himself in order that the client may appraise his general character and demeanour and discuss with him the project in general, so that he may finally negotiate an agreement with him for the work in question.

The safest and best procedure for an owner or client to adopt in the appointment of his consulting engineers is as follows:

(1) To prepare a list from personal knowledge or recommendations by qualified sources, such as other employers or engineering societies, of firms of consulting engineers considered suitable for the project in question.

(2) To invite the firms on that list to submit their qualifications, experience and capacity for undertaking the project on behalf of the client.

(3) To select from these proposals one or more consulting engineers to be interviewed.

(4) To determine which one of the consulting engineers interviewed is best qualified for the particular engagement under consideratior

(5) To negotiate with the consulting engineer so selected for services of the nature and extent required. The reasonableness of the fees to be charged may be checked from personal knowledge or from other employers or engineering societies.

(6) To enter into an agreement with the consulting engineers selected on the basis of the negotiations for the services

required. Engagements involving preliminary investigations and reports should commit the consulting engineer to limiting fees in case additional engineering services are required at a later date on the same project.

(IV) Duties of Consulting Engineers

It is worthwhile explaining in general terms the normally accepted duties of a consulting engineer. When a project is conceived by an authority or industrialist, many factors connected with the scheme may be unknown. It may, for instance, be desired to store water on a monsoon-fed river for irrigation and power generation purposes. Before even the most preliminary designs can be made, many data must be collected, and if the authority does not have the personnel available, the study of the whole scheme could be handed over to consulting engineers.

If the preliminary investigation indicates the practicability of the scheme, and it is decided to proceed with further investigations, it would be the duty of the consultants to carry out ground surveys for the structures and buildings, or arrange on behalf of the client, for test borings, trial pits, test piling, etc. and for the supply of any models and other investigations which may be required. They would select the best type of civil works or buildings and the correct pressure for boilers and generating plant, the most suitable types of water turbines or other plant and machinery. In fact, they would advise on all matters connected with the scheme.

On the result of the tests and investigations, the consulting engineers would be able to complete the Project Report from which the final decision would be taken regarding actual construction work. When the Project Report is accepted and the consulting engineers appointed

for the complete scheme, it is their duty to draw up all detail plans, designs and specifications, as well as the forms of tender and conditions of contract.

The consulting engineers would advertise or negotiate on behalf of the client for tenders and on receipt of them would advise the client as to the most acceptable offer. On the appointment of a contractor, the consultants would approve the contractor's working drawings, inspect the plant during manufacture, and supervise all the work during construction. Finally, when the works are completed, they would carry out the taking-over tests, certify their correctness, and hand over the completed job to the clients ready for normal operation. After the construction work is completed, they would, if required, assist the client during the preliminary operational stages.

Thus the consulting engineers relieve the client of all the detailed engineering work during the construction period and so enable him to concentrate on building up the permanent organization which will be required for operating the works when completed. They do, however, carry out their work in collaboration with the client so as to ensure that the completed works are such as to fulfil his requirements.

Where the client is engaged on large-scale operations embracing a regular programme of construction extending over many years, it is, of course, usual for the client to have a permanent engineering organization and for the consulting engineers to be brought in for special advice and to deal with certain of the larger schemes which might otherwise overtax the resources of the client's permanent organization. In this event, the consulting engineers naturally maintain close collaboration with the client's chief engineer and his staff throughout the progress of

the work and in particular consult with them on all major questions of design and placing of contracts.

The services rendered by consulting engineers are a necessary part of any engineering undertaking. That is to say, these services have to be carried out whether consulting engineers are employed or not. Consequently the cost of these services is an inevitable part of the cost of the job. Long experience has shown that in most cases these costs are greater if the work is undertaken by the promoter of the project, since he does not have the special experience or organization necessary for such duties. If the work is undertaken by the contractor, the extra cost will appear in the contract price, with the disadvantage that the client is very largely in the contractor's hands, and the work is inevitably designed and organized to meet the contractor's commitments. The consulting engineer, on the other hand, has built up his organization with the primary object of providing such services in the most efficient and impartial manner at the lowest possible cost.

Consulting engineering is a profession, just as those of medicine, the law, architecture, etc., and its members are bound by codes of conduct and professional etiquette.

The employment of consulting engineers is not peculiar to any one part of the world. In most countries, their value and duties are well known, and even though the large railway companies, dock authorities, electricity supply authorities, manufacturing firms and Government Public Works Departments have their own trained engineers for normal work, the broader experience and specialist knowledge of consulting engineers is often called upon when major new schemes are launched. This may be compared with the normal practice in the medical profession of obtaining a second opinion or of calling in a specialist.

It should be appreciated by the client that the consulting engineer is just as interested as the client in early completion of the work, since the later the completion, the heavier the overhead charges which the engineer has to face. The greater the time to complete the works, the greater is the financial strain on the engineer, but his extensive experience generally enables many pitfalls to be avoided which might otherwise lengthen the construction period. It is in all these ways that a consulting engineer can render services to his client and act in his best interests, where others undertaking the same work cannot be of the same value to the client.

(V) Terms of Reference

Wherever possible, terms of reference covering what the consulting engineer is required to do should be given to him at the time that he is asked to put forward his proposals. These terms of reference will vary from project to project, but in general many of the terms will be required in a similar form in all projects, but separate terms of reference will be required for -

1. Preliminary investigations and project reports;
2. Designs, specifications, preparation of contract documents and supervision.

It is possible to draw up model lists of these terms of reference which are mainly of general application to all jobs, providing it is borne in mind that not all items are applicable to every job.

1. Preliminary investigations and project reports -
   a. General consultation with client as to his requirements;
   b. Preliminary site surveys, such as may be necessary for the purpose of the project report;

c. Investigation of all available data or information relating to the proposed works;

d. Advice to the client as to the necessity for special investigations of conditions of subsoil, tide or weather;

e. Arranging for the carrying out of such bore holes, test piles, trial pits, soundings, marine or hydrological investigations as may be necessary;

f. Interpretation of the results of such investigations;

g. Preparation of sketch plans, showing the project in general outline;

h. Preparation of market studies;

i. Preparation of traffic studies;

j. Investigation and recommendations on proposed or existing management;

k. Preparation of economic study of the project;

l. Consideration and recommendation on operation of the project when completed;

m. Consideration of commercial feasibility of the project;

n. Estimates of cost of construction;

o. Estimates of time schedules and programs for construction;

p. Proposed rates for operation;

q. Consideration of international boundaries where applicable;

r. Consideration of associated works necessary, such as temporary housing, access roads;

s. Consideration of compensations which may be payable, such as for flooding land;

t. Recommendations on purchase or acquisition of land;

u. Consultation with any architect or other advisor appointed by the client in regard to architectural treatment or other features of the works.

2. Designs, specifications, preparation of contract documents and supervision -

a. Preparation of detailed site surveys;

b. The making of designs, drawings, specifications and preparing schedules or bills of quantities;

c. The preparing of conditions of contract, forms of tender and invitations to tender and submitting these for approval and decision by the client;

d. Advising the client as to lists of tenderers.

e. Advising the client as to tenders, tenderers, prices and estimates for the carrying out of the works;

f. Advising as to the preparation of the contract relating to accepted tenders;

g. Preparing any further plans, designs and contracts necessary for the carrying out of the works;

h. Examining and approving contractors' and manufacturers' details;

i. Making arrangements on behalf of the client for the inspection and testing during manufacture of such materials and plant as are usually inspected and tested;

j. Issuing instructions to contractors and manufacturers and generally supervising the execution of the works;

k. Providing time schedules and progress reports;

l. Providing forecasts of funds required;

m. Issuing of certificates for payments to contractors and manufacturers;

n. Supervising acceptance tests on site;

o. Assisting in settling disputes or differences that may arise between the client and contractors excepting litigation and arbitration;

p. Providing the client on completion of the works with such record drawings as are necessary for operation and maintenance;

q. Assisting the client in organizing management;

r. Assisting the client on putting the project into operation and organizing and training an operating staff.

(VI) Fees for Consulting Engineers

The remuneration of the consulting engineers for the performance of their service as outlined above can be made in a variety of ways. Two or more methods may be combined in any project and fees should be agreed beforehand to suit each particular case. The following are the bases usually employed:

(1) Percentage of cost. (Fee based on a percentage of actual cost of work contemplated or constructed.)

(2) Fixed lump sum fee

(3) Cost plus a fixed fee

(4) Daily or hourly rates

(5) Cost plus basis where scope of work is difficult to determine

(6) Retainer fees

The decision concerning the acceptable method of computing fees on a particular job necessitates consideration of various important items, each of which has a bearing on the agreement for service to be entered into between the engineer and his client, as each agreement should be drawn to meet specific conditions. The following description

of each of these methods of calculating fees is taken from the Manual of Professional Practice of the American Society of Civil Engineers, but is applicable to all consulting engineers generally throughout the world.

Percentage of Cost of Work

Compensation based on a percentage of the final net cost of construction is the usual and most convenient method.

If the services cover only estimating and design or if the construction is postponed or cancelled, compensation is based on the estimated construction cost as determined by the Engineer.

Cost of work constitutes the adtual total construction cost in place, including labor, materials, equipment, etc., but excluding the engineering cost. Also excluded as items of "net cost" are the cost of financing, commissions, cost of real estate, legal and other similar expense.

Fixed Lump Sum Fee

Compensation under this method is usually arrived at by negotiation in which the amount of the fixed lump sum may be deterrined by either of two methods. In the first and preferable method, the lump sum fee is determined by applying a percentage to the estimated construction cost, and stating the result as a lump sum.

The second method may be used in cases where the estimated construction cost is difficult to determine but where the client desires to develop a lump sum fee for the engineering service required. In this method, the lump sum fee is the sum of the following three items:

a. Estimated direct payroll costs.

b. Estimated overhead costs as defined (page 16).

c. A surcharge on the total of (a) and (b) above of not less than 50% of that total representing compensation and profit to the engineer.

In addition, the engineer should be reimbursed for all travel, subsistence and other out-of-pocket expenses directly chargeable to the work. In instances where unusual specialized skill and judgment are required, the above method plus a per diem is recommended.

Under this method, the agreement should include a stated time limit for the performance of the services and a provision for additional compensation for changes required to be made after preliminary plans have been approved. Further provision should be made for equitable adjustment in compensation in case the original project is expanded or reduced in scope.

Cost Plus a Fixed Fee

For many civil engineering projects, the engineer is required to start work before the scope of the project can be accurately defined and estimated. This indeterminate project scope generally results from the requirement for special studies, research or experimental work, preparation of estimates for alternate types of construction, etc.

For this type of project, the cost plus a fixed fee method offers a satisfactory basis for performing such service.

Under cost plus fixed fee agreements the engineer is reimbursed for the direct cost of services, supplies, etc., including:

a. Salaries of engineers, designers, draftsmen and other technical employees engaged on the project.

b. Drafting, clerical and stenographic expenses and supplies.

c. Blueprinting, photostating, printing and other reproduction costs.

d. Telephone, telegraph and postage expenses.

e. Travel and living expenses of principals and other employees on business connected with the project.

f. The cost of any other items directly chargeable to the work or agreed to be included at the time the agreement is made.

If the services are performed in the engineer's home office, the applicable indirect or overhead expenses of the engineer are properly added to the direct costs. Overhead is generally computed as a percentage of the productive payroll, i.e. the salaries of engineers, designers, draftsmen and other technical employees while engaged on the project.

Cost plus fixed fee services at times are required to be performed in a field office at or near the site of the project. The consideration dictating this procedure is generally the necessity of getting the project started as soon as possible, the plans being developed as the construction work proceeds.

The computation of the applicable overhead allowance for cost plus fixed fee services performed in a field office may be subject to negotiation between the engineer and the client. Such services absorb a certain capacity of the engineer to take on additional work, and an equitable charge for overhead is justified.

In addition to reimbursement for direct and indirect costs, the engineer is paid a fixed fee, which usually ranges from 2% to 4% of the construction cost depending on the size and character of the project and scope of the engineering services involved. In many cases, the fixed fee is calculated as a percentage of the estimated construction cost as determined by the Engineer.

Daily or Hourly Rates

The per diem basis of compensation is particularly adapted to Court work or similar work involving irregular personal service.

When such consulting or expert services are furnished, the engineer is compensated for all time devoted to the work, including time of travel. The per diem fee should be based on the complexity of the work involved

and the breadth of experience of the engineer. In addition to the compensation based on the per diem, the engineer is reimbursed for travel, subsistence and other out-of-pocket expense incurred while away from his home office.

For Court work or other engagements on which the engineer is to appear as an expert, a per diem is considered to have been earned for each day of such appearance, although he may not be called to testify, or if called, may finish his testimony in a fraction of the day.

On occasions, the urgency of the engagement requires the engineer to work longer than the customary seven or eight-hour day. In such instances an understanding with the client should be made as to what constitutes a per diem, as the urgency may require the engineer to work more than the usual hours per day in order to complete his work. In such cases, the per diem may be based on the normal number of working hours per day or the per diem rate may be increased to take into consideration the extended work day.

For certain kinds of work, compensation based on hourly rates makes an equitable arrangement. Compensation for engineering service on an hourly basis demands a higher rate per hour than would be represented in a per diem rate. Also, the hourly rates should apply to time required for travel involved, plus reimbursement for travel costs, subsistence and other out-of-pocket expenses. Depending on the duration of the services, compensation on an hourly basis may fairly include an agreement on an upset minimum amount or retainer in addition to the payments based on the hourly rates.

Cost plus Basis where Scope of Work is Difficult to Determine

There are numerous cases where the extent of the engineering service required is difficult, if not impossible, to pre-determine. Under such

circumstances it is impossible to establish fees as a percentage of estimated construction cost. In this general classification and where partners' or officers' time comprises a major portion of the engineering costs, per diem rates mutually agreed to by the client and the engineer are recommended, with reimbursement for travel, subsistence and other direct expenses.

In other cases in this classification, a reasonable fee may be developed by use of the second method outlined in "Fixed Lump Sum Fee".

In still other cases of this general type, the cost plus a fixed fee method, as previously outlined, will provide the best basis for negotiating the fee.

Retainer Fees

The employment of engineers on a retainer fee basis is a common practice of clients who wish to be assured of always having available in the future the services of a certain individual engineer or organization.

This method is used in cases of protracted litigation, when the calls upon the engineer may be intermittent. It is also used in the development of undertakings for which the services of an engineering specialist are not required on a full time basis. Industrial companies may also employ on a retaining fee basis the engineers who prepared the plans and specifications for manufacturing plants and thus are familiar with any problems arising from maintenance or plant additions.

The amount of the retainer varies with the character and value of the services to the client and the reputation and standing of the engineer in his profession.

The terms of agreements for services on a retainer fee basis also vary widely. The compensation may be based on a fixed sum, paid monthly

or on some other mutually agreeable basis, with per diem or hourly rates in addition for time spent at the request of the client.

In any case, the same principles as explained previously for per diem or hourly charges govern in their use under retaining fee agreements.

Overhead

Overhead may be defined as those costs incurred which do not contribute to the solution of the engineering problems at hand, but which are nevertheless essential to the continued operation of an engineering business. Depending upon the size of the engineering organization, items of overhead expense may include any or all of the following:

Rent, including utilities; administrative expenses of conducting business, accounting and purchasing, business promotion, clerical and stenographic help, unallocated salaries, taxes except Federal and State income taxes, office supplies and equipment, insurance, including life insurance on officers of the firm, telephone and telegraph; legal expenses; bad debt provision, depreciation on furniture and equipment; library and periodical expense.

The following are also commonly included as items of overhead: Social Security, unemployment, excise and payroll taxes, employees' compensation insurance, sick leave, vacation and holiday pay. Under some methods of accounting, the items in the previous sentence are considered as a part of direct payroll or salary cost. Overhead is commonly expressed as a percentage of productive payroll, i.e., the salaries of engineers, assistants, designers, draftsmen and other technical employees engaged on the project.

The amount of overhead cost incurred will vary from month to month and from job to job, depending upon the type of work and work load in which

the engineering firm is currently engaged. Overhead may range from as low as 25% to 100% and more of direct costs.

Re-use of Plans

Plans represent the product of training, experience and professional skill and accordingly belong to and remain the property of the producer unless specifically agreed to the contrary. Certain engineering organizations systematically cover by "copyright" all plans, sketches, and designs prepared by them in order to protect themselves in possible cases of piracy of their ideas.

While direct copying of engineering designs is infrequent, in submitting novel designs or plans solving difficult problems in construction, the engineer should protect them either by copyright or by requiring the recognition of ownership through a proper provision in the contract for service or both.

Interim Payments

Interim payments for engineering services should be provided for as the work proceeds. Provision should be made for compensation, if for any reason the work is abandoned or deferred. The details covering payments may differ with each job according to the conditions involved. It is quite customary for an interim amount to become due and payable when a preliminary study is completed and the report rendered, and again when detailed plans and specifications are completed or when the construction contracts have been signed. Sometimes such arrangements for interim payments are made on a more frequent basis. In any case, interim payments should be made promptly after the engineer has completed each phase of his work whether or not the next phase is begun.

Items to be paid for in addition to Percentage Fee

The following items of cost cannot be determined accurately in advance and are not within the sole control of the engineer. Ordinarily they are paid for in addition to the percentage fee in the manner stated and the engineer should keep separate complete accounts of these five items:

1. Field surveys, property, boundary and right-of-way surveys, flow gaging, specialized sub-surface investigations, or similar instrumental work for preliminary investigations and report; instrument surveys for design; and services of resident engineers and inspectors.

A fee based on salary cost plus 100 percent, plus reimbursement for actual travelling and subsistence expense, long distance telephone and telegraph charges and similar direct field expense.

2. Services of locally employed field staff additional to resident engineer and inspectors:

A charge based on salary cost plus 50 percent, plus reimbursement for necessarily incurred travelling and subsistence expense and supplies.

3. Furnishing reproduction of drawings or of detailed plans and specifications.

At cost plus 50 percent service charge, or at price agreed upon with the client.

4. Services during readvertisement for bids for construction:

A charge based on salary cost plus 50 percent, plus reimbursement for necessarily incurred travelling and subsistence expense, long-distance telephone and telegraph charges, and payment at recommended rate for needed additional copies of plans and specifications.

Limiting lump sums for the above services are often included in engineering contracts.

5. The client should pay directly, and in addition to the percentage fee, for special tests and research, mill and shop inspection of materials and equipments, sampling and analyses of water and sewage and for foundation explorations such as borings, test pits and soil mechanics laboratory investigations, whether for preparation of preliminary report with estimated cost, or for final detailed plans and specifications.

Litigation

Nothing should be written in the engineering agreement to obligate the engineer to prepare for or appear in litigation in behalf of the client, except in consideration of additional compensation.

Re-design required by Client

When re-design of work is required by the client after the preliminary report or preliminary plans have been approved, compensation for such re-design should be on basis of salary cost of employees plus 100 percent in addition thereto for allowance for overhead and principals' time. In addition, reimbursement should be made for travelling and subsistence expense, long-distance telephone and telegraph charges and similar direct expense occasioned by the work of re-design.

(VII) Relations of the Engineer with the Client

It is valuable to outline the relations of the consulting engineer with his client as normally accepted.

1. The engineer may act as designer, supervisor of construction, professional adviser to the Owner, or in all three capacities, or in combination of these capacities. He shall act in a strictly judicial manner.

2. The engineer is entitled to compensation for professional advice. He should not offer such advice free. His charges for services should conform to general practice and should always be adequate to permit conscientious compliance with assumed obligations.

3. Unless authorized by the owner, he shall not receive directly or indirectly any royalty, gratuity or commission on any patented or protected article or process used in connection with work upon which he is retained by the Owner; nor shall he accept without the Owner's consent any trade commissions, discounts, allowances, indirect profits or other secondary considerations in connections with any professional service which he undertakes for the Owner.

4. He shall not directly or indirectly engage in any of the building trades while practicing professionally.

5. He shall inform the Owner of any business connections, interests, or circumstances which might influence his judgment or the quality of his services.

6. Consultation with engineers who have made certain branches of professional work a specialty, or who have acquired a pre-eminent standing should be encouraged by the engineer having general charge of any work, and may be required by the Owner. In either case, the engagement of the consulting engineer should be satisfactory to both the owner and engineer and shall be at the expense of the owner.

No engineer shall agree to act as consulting engineer except at the request or with the knowledge of the engineer in direct charge of the work; and his reports and advice should be confined to the particular matters upon which he has been consulted.

Charges for consultation should take into account the value of the services rendered as well as the time spent in arriving at conclusions or opinions.

7. The engineer when acting as supervisor is the official interpreter of the agreement and shall insist upon its faithful performance by both parties.

8. Planning, designing and supervising are the functions of the engineer. All problems involving these functions should be presented to the engineer rather than to the contractor.

9. As a complete service, the engineer shall furnish promptly whatever general, structural and mechanical plans, details and specifications are needed for bidders or contractors. He shall not require bidders, contractors or sub-contractors to make gratuitously drawings or specifications which it is his duty to furnish.

10. He shall not attempt to conceal possible oversights or errors, nor to shirk responsibility by indefinite clauses in contracts or specifications. Specifications shall clearly define unusual trade terms or trade names and customs understood to be part of the specifications.

11. The engineer will generally find it advantageous to himself and to the owner, before plans and specifications are detailed, to have the owner committed to a program of awarding contracts; that is, to have him decide whether he will let a general, a segregated, a lump-sum, a cost-plus fee, a unit price or other form of contract.

12. The engineer is entrusted with financial undertakings in which his honesty of purpose must be above suspicion; he acts as professional adviser to the owner and his advice must be absolutely disinterested;

he is charged with the exercise of judicial functions as between owner and contractor and must act with entire impartiality; he has moral responsibilities to his professional associates and subordinates; finally, he is engaged in a profession which carries with it grave responsibility to the public.

(VIII) Approvals and Recommendations by the Bank

In general, for all projects of an engineering nature for which applications may be made to the Bank for consideration for loans or other purposes, the Bank will require a report covering investigations, estimates and project appraisals. For this purpose, the Bank will require that consulting engineers shall be appointed to prepare the project report on the basis of terms of reference such as those outlined above for preliminary investigations and project reports (page 10). In general, in all cases of project development involving engineering, the Bank will require the appointment of consulting engineers for the design and supervision of execution of the project. Such engineers will be appointed on the basis of terms of reference such as those outlined above for design and supervision of construction (page 12). Whether consulting engineers are appointed by a member country of the Bank or borrower, before or after an approach has been made to the Bank, the Bank in all cases reserves the right to approve of the consulting engineers appointed and to approve of the terms of reference given to the consulting engineers. In accordance with the Bank's policy, firms would not be approved from countries which are not members of the Bank, except Switzerland. Where consulting engineers have not been appointed before an approach is made to the Bank, the Bank would agree with the

borrower on the terms of reference to be given to the consulting engineers and where the borrower is unable to prepare these terms of reference for himself, or asks the Bank to assist in the matter, the Bank would assist by recommending suitable terms of reference to the borrower, based on the lists above. In considering the appointment of consulting engineers, the Bank would, if necessary, advise the borrower on the questions to be asked from the proposed or contesting firms of consulting engineers as outlined in "Selection of Consulting Engineers"(Page 4) for the purpose of enabling the borrower to make his selection of consulting engineers and where the Bank is to give approval of consulting engineers, the borrower should be required to submit to the Bank the answers to the various questions which he has received from the proposed or contesting firms of consulting engineers. In the event of the member country or prospective borrower not knowing how to proceed with the appointment of consulting engineers, the Bank would be willing to assist in this respect, advising the borrower on the questions to be asked and terms of reference to be given to the consulting engineers. In the event of the member country or prospective borrower still further requiring assistance in the names of suitable firms of consulting engineers to approach, but only if necessary, the Bank would be willing to provide such a list. In doing so, the Bank, in preparing a list of firms of consulting engineers for submission to the member country or prospective borrower, would have regard to the following points:

(1) That the list should, where possible, be restricted to firms of consulting engineers in Categories (A) and (B) and that firms in categories (C), (D), (E) and (F) should not be included in the list unless essential

or necessary because of some specific reasons involved in some particular cases. A list containing a mixture of firms from Categories (A) to (F) is not advisable. Where firms in Categories (A) and (B) are not available and suitable, then selections can be made, according to circumstances, from Categories (C), (D), (E) and (F).

(2) The list should be as international as possible, having regard to the circumstances of each particular case. It should be remembered that some countries such as the U.S.A. and U.K. have a far larger number of firms of consulting engineers than some other countries such as Holland, Sweden or Italy, which may have only one or two firms. In order to maintain an even balance, therefore, an international list should contain a larger number of firms from the U.S.A. and U.K. than from other countries.

(3) The list should be varied as much as possible, that is to say, a firm should not be recommended on two consecutive lists if other equally suitable firms are available and suitable for the same work.

(4) Consideration should be given to the known load and capacity of the firms considered for a list.

(5) Consideration should be given to the experience of the firms in the class of work to be undertaken.

(6) Consideration should be given to the experience of the firms in various parts of the world and particularly in the vicinity of the work to be undertaken.

Based on the above considerations, suitable lists can be prepared in the Bank from an examination of the Register of Consulting Engineers for submission to the client, and with this list the client can act in accordance with the procedure outlined above.

When the Bank is required to prepare a list of consulting engineers for submission to the client, the list should be accompanied by the following qualifications:

1. That the list is not exhaustive;

2. That the firms named are qualified but that whether any of them should be employed must depend, among other things, on the number and qualifications of the staff who can be made available for the particular project;

3. That the client is free to invite proposals from any firm of consulting engineers not included in the list, provided that before any actual appointment is made, the Bank's approval of the firm is sought if its name is not included in the list submitted by the Bank, the assumption being that further approval is not required by the Bank if any one of the firms on its recommended list is chosen, as these would not be put on the list if the Bank were not prepared to approve of them, subject always, of course, to their proposals being acceptable.

4. That the client shall provide suitable terms of reference which shall be previously agreed with the Bank;

5. That in seeking proposals from the consulting engineers, the client shall adopt the procedure outlined above and require the proposed firms of consulting engineers to answer the questions given above as may be agreed between the client and the Bank.

Where the client submits a list of proposed names of consulting engineers to the Bank, the Bank would give consideration to the following circumstances:

1. That the list is all from one country or not sufficiently international;

2. That any of the firms are not qualified;

3. That there are other better firms not included in the list;

4. That the list contains a mixture of firms from Categories other than (A) and (B).

At as early a stage as possible in discussions between the Bank and the client in regard to the appointment of consulting engineers, the Bank would make known to the client its desire that as far as possible, and providing circumstances permit, the selection of consulting engineers shall be from Categories (A) and (B). In the event of a client wishing to appoint a firm from Categories (C) to (F), the client shall make clear to such firm or firms at the earliest stage that in the event of their undertaking work as consulting engineers, and providing a Bank loan should result, they or their associated firms would not be permitted to take part in tendering for contracts for construction or the supply of equipment or plant. In other words, a firm which undertakes contracting work or manufacture of plant and equipment as well as consulting engineering must make up its mind at the initial stage whether it wishes, in that particular project, to act as consulting engineers or to act as contractors or suppliers and it should be made quite clear to them that for a project with a Bank loan or in which the Bank is interested in any other way, it would not be permissible to act as both consulting engineer and contractor, or as both consulting engineer and supplier.

There has recently come to light the action which has been taken by the Ceylon Government in connection with Stage 2 of the Aberdeen-Laksapana Hydroelectric Scheme. Attached hereto as Appendix III is a

copy of a letter dated 12th December, 1955, which the Ministry of Transport and Works of the Ceylon Government has sent out to a number of firms of consulting engineers, contractors and others. This is a clear case where the Department of the Government concerned does not appreciate the implications of the circular letter which it has issued. Should they proceed with the scheme on the basis of this letter, whether with or without a Bank loan, by appointing a firm or firms which have put in proposals in accordance with this letter, they would be laying up trouble for themselves which would probably result in increased costs, inferior work and possibly even litigation.

It is cases such as this, which are not isolated ones, which make it necessary that the Bank should inform the borrower at the earliest stage of its views in regard to the appointment of consulting engineers and ensure that the prospective borrower fully understands the difference between consulting engineers and constructing firms and suppliers, and the implications involved in undertaking work on a basis such as that outlined in the letter from the Ceylon Government.

The Bank would reserve to itself the right to approve or comment on the proposed agreement with the consulting engineers, which agreement should include in all cases the terms of reference.

(IX) The Bank's Requirements and Commitments in regard to Consulting Engineers

Where the Bank has approved the appointment of consulting engineers either for preliminary investigations and project reports or for design and supervision of construction, they should regard the consulting engineers as advisers and consultants to the client, acting in the client's best interests and through the client to the Bank itself. In other words, they should be regarded in the same light as one would regard

advice from a surgeon or lawyer. The Bank should regard their advice as being the best obtainable and would accept such advice except in unusual circumstances or for very special reasons. It is not professional or ethical for a firm of consulting engineers to report on the work of another consulting engineer except with the latter's knowledge and approval or if his appointment has been terminated. A reputable and ethical firm of consulting engineers would not undertake such an assignment without assurances on these points. The Bank is not necessarily committed or bound by the advice and recommendations of consulting engineers, but in appointing or recommending or approving their appointment, should be willing to have sufficient confidence in them to accept their recommendations and proposals, unless and until circumstances should warrant otherwise. Should the Bank not be satisfied with the work of consulting engineers, they should be free to discuss the matter with the client and the consulting engineers and in the event of the Bank not being satisfied with some action taken or advice or recommendations, they should be free to consider whether they have lost confidence in the consulting engineers to such an extent that it would be desirable to terminate their appointment or require the client to do so and appoint others. It is advisable that the Bank should reserve to itself the right to -

1. Approve or comment on proposals received by the client from consulting engineers,
2. Take steps to ensure that the consulting engineers have the authority to carry out their responsibilities efficiently,

3. Maintain direct relations with its borrowers' consulting engineers, but only if necessary,

4. Give the consulting engineers support in their relations with borrowers,

5. Require the borrower to advise it of cases in which the borrower acts contrary to the advice of the consulting engineers.

The Bank should require the consulting engineers, where possible, to draw up all specifications and plans in such a way as to be suitable for international tendering, and where international tendering is possible, no specification should be drawn up in such a way as to give advantage to one country's contractors or manufacturers. Where, in documents, it is advisable or necessary to specify an article or method of work by reference to a particular firm's manufacture of an article or method of work, the words "or other approved" should be added at the end of the sentence specifying such article or method of work. Where a specification is drawn up in such a way that it favors one particular country, and it is not possible to include alternative specifications to cover all countries, a clause such as the following should be added at the end of the specification or specifications:

"Any firm tendering and unable to comply with this sepcification or specifications, by reason of country or common usage such as because of different standards normally adopted in the country of the firm tendering, should tender on the basis of specifications and materials normally adopted in the country to which the firm is accustomed, providing such standards are at least equal in quality to the articles or methods specified or implied in these specifications."

Where a tenderer wishes to put forward alternative proposals by reason of his views on the proposed designs or specifications, but not by reason of different standards in the country from which he works (which is covered by the above clause) he should be permitted to submit his alternative proposals, provided always that he also submits a tender based on the designs and specifications provided (except as varied by the above two clauses).

These requirements of the Bank in regard to the work of consulting engineers might be included in an appropriate form in the Bank Loan Agreements.

(X) Consulting Engineers' Agreements and Fees

It may be useful for the Bank to have a model form of agreement of a type which is normal as between a consulting engineer and his client. Such a form might be of value when the Bank is discussing with borrowers the appointment of consulting engineers and would be a guide to borrowers who may not be familiar with such agreements. It must be remembered, however, that no two sets of circumstances in regard to the appointment of consulting engineers are usually alike and, therefore, no model form will be acceptable in all circumstances and must be adjusted to suit each set of conditions. In other words, it can normally only be taken as a guide and used as a basis to prepare an agreement in each particular case. Such a model form of agreement is attached hereto as Appendix IV. This form has been taken from the Model Forms of Agreements published by the Association of Consulting Engineers of Great Britain but is generally acceptable to all professional firms of consulting engineers throughout the world.

The various methods of remuneration of consulting engineers have already been described (page 13 et sig.) and do not in general require further elucidation. But, as the most usual method adopted for determination of fees is that based on percentage of cost, either estimated or actual, there are certain scales of fees recommended by the various associations of consulting engineers. The fees recommended by the British Association of Consulting Engineers and the American Institute of Consulting Engineers have been tabulated in the form of graphs. Further graphs have been estimated showing the various additions and deductions which may be made, according to the requirements of particular circumstances, to cover certain items which are regarded as extra to the basic fees or which may be deductible if certain services are not performed. The composite graphs are attached hereto as Appendices V, VI and VII, but here again it must be pointed out that circumstances vary and the graphs must be taken as a guide only. The following are examples of cases where the amount of work to be performed by the consulting engineer is not normal:

(a) The work is of an unusually complex or difficult character;

(b) The work is exceptionally large in extent or very simple in character, e.g., long tunnels, long lengths of roadwork, large dredging contracts, long lengths of large diameter trunk water mains or sewers;

(c) The works are to be carried out by direct labor, or partly by direct labor and partly by contract;

(d) The works are to be carried out by means of many separate contracts;

(e) The work comprises substantial alterations or additions to existing structures;

(f) The execution of the work is retarded in order to spread the costs over a number of years;

(g) The work is for a client of long standing who retains the same Consulting Engineer on a regular basis for the execution of the majority of his work;

(h) The work is to be carried out overseas in a remote area or under difficult or unusual conditions;

(i) The works are novel in character, and involve the use of experimental materials or techniques;

(j) The work includes a high proportion of buildings and building work;

(k) There is a large amount of reinforced concrete work and bar bending schedules are required;

(l) There is a large amount of structural steel work;

(m) The work requires a large amount of inspection work and witnessing of tests on plant and equipment;

(n) The engineers are required to assist in operation and management;

(o) The engineers are required to employ or use an excessive percentage of comparatively inexperienced local staff;

(p) The engineers are required to train local personnel.

In any of these cases, adjustments will be required in the recommended scales of fees. The graphs could, however, be used for comparison purposes when considering the suitability of fees proposed in any particular case, provided any special circumstances are taken into account when making the comparison.

APPENDIX I

SUPPLEMENTARY REPORT ON THE PLANS AND SPECIFICATIONS OF THE *** COMPANY FOR CONSTRUCTION OF WATER SYSTEMS IN ***

Relationship Between Client, Engineer and Contractor

In the construction of public water systems the client engages a consulting engineer to design such works in the event that their own engineering service is not adequate to carry on the work or sufficiently specialized. The client selects the consulting engineer not on a competitive bidding basis but on the basis of the engineer's reputation, technical ability, experience and availability to do the particular water supply study job. It is much the same procedure as an individual selecting a physician. One does not go out and secure competitive bids from various physicians to give one medical care, but selection is made upon the aforesaid qualities. The person selected should be one in which the client has implicit trust and confidence.

The consulting engineer, for a certain fee, then proceeds to make a preliminary study of the project in question, reviewing all possible solutions for obtaining a water supply or the best method for improving an existing water supply system. When these preliminary studies are completed a report is submitted to the client. The client then determines whether the project as proposed or recommended will be undertaken or postponed. In the event that it is decided to undertake the project, the engineer is then instructed to draw up detailed construction plans and specifications to carry out the project. When these detailed plans and specifications are completed it is customary to advertise for bids for construction by competent contractors who are skilled in water

supply construction. After the competitive bids are received the client makes a selection of the contractor with the advice of his consulting engineer. Usually the lowest bidding contractor is accepted if he is financially responsible and technically able to carry out the project. The contractor then proceeds with the construction of the project following in detail the construction plans and specifications under the supervision of the consulting engineer or his representative, the so-called resident engineer on the job.

If there are minor ambiguities in the specifications or contract, the consulting engineer is the arbitrator. However, in the event that the additional work is really beyond the scope of the specifications the contractor has the right to additional remuneration. This remuneration may ultimately have to be determined through legal processes in the courts. The equipment that is purchased for the construction project can either be purchased directly by the client or by the contractor. However, in all cases it must meet the specifications that have been set up by the client and his consulting engineer.

Thus, in a project of this type one has the client and his consulting engineer as one party to a contract and the contractor the second party. If the contracting, engineering and supplying of equipment are done by one party, it is considered unethical.

Specifications

In carrying out water supply construction work there are usually three major parts to a contract, the contract itself giving the terms and scope of the work, the conditions under which it is to be carried out and the payments to be made on the project and the necessary

performance bonds, penalties and bonuses to be paid for completion of the project.

The second part consists of detailed construction plans consisting of detailed drawings clearly showing the work to be performed by the contractor.

The third part of the so-called specifications gives in detail the kind of work to be done, the manner in which it should be done, the quality, quantity, kind and size of materials to be used.

The quality of materials to be used frequently designated by following some accepted standard, either international or, in many cases, American or British. These standards have been promulgated by careful professional study and research and usually accepted both by the engineering and industrial organizations. For example, in the United States specifications may be marked as follows:

ASTM - American Society of Testing Materials
AWWA - American Water Works Association
UL - Underwriters' Laboratory, Bureau of Standards, Department of Commerce

Frequently, instead of going into a detailed specification for each type of equipment, the specifications may state a certain catalogue number for a piece of equipment, specifying this catalogue number of a particular manufacturer or the substitution of equipment of another manufacturer with equal specifications. The specifications are prepared by the engineer as information to the contractor and it is upon the basis of the specifications that competitive bids are made by various contractors. The specifications should be in sufficient detail to insure a minimum of ambiguity so that the contractor knows exactly what the client

and engineer desire. Indefiniteness in specifications leads to controversy, delay and costly legal action.

For example, it is not sufficient to say in specifications a 12-inch valve. To illustrate this point I have taken from the Jenkins Manufacturing Company Valve Catalogue No.76 a list of 12-inch valves that could be utilized in water systems and meet the above indefinite specification. This list is appended to this document. You will note that there are 23 different valves varying in their list price from $125.00 to $425.00. Each one, however, has a definite use. In the event that the engineer did not specify the particular type of valve it would be natural for the contractor to put in the cheapest valve for, after all, he is in business to make money.

The same thing can be illustrated by having indefinite specifications for concrete work. For example, a 1:2:4 mix of concrete would require about six bags of cement per cubic yard of concrete, while a 1:4:8 mix would require less than three bags of cement per cubic yard of concrete. Therefore, unless the proper amounts are specified, there is a tendency for the contractor to use the leaner mixes with a consequent greater profit to himself, but possibly very damaging to the stability and safety of the structure.

The amount of water used in making a cubic yard of concrete is also very important. By using a larger amount of water one obtains concrete that is very nice in appearance but actually is not as strong structurally as concrete made with lesser amounts of water. Therefore, the water content of concrete must be specified.

Plans and Specifications for the *** Plant

I have reviewed the three volumes of the so-called plans and specifications prepared by the *** Company for the *** water filtration job. This job essentially consists of making an addition to the existing filtration plant and building a new water filtration plant together with a trunk line pipe connection.

These cannot be called truly contract drawings and specifications for construction. They certainly would not be clear enough for competitive bidding. Actually, they are more in the order of a description of the competentness of the *** Company, their experience and a proposal of what they can do for the city. They are simply a reflection of what happens when an equipment manufacturer, and I believe the *** Company could be considered a competent one, undertakes to do engineering, supply the equipment and do the construction of the job. Actually, it is a very unsound practice and I believe costly and not to the best interest of the client.

For example, in the report there are photographs of the *** plant which is apparently a filtration plant built by the *** Company. There are also photographs of *** plant and a photograph of the filtration plant in *** , although in the latter case the writer knows that this filtration plant was not designed by *** Company, which simply supplied the equipment.

One part of the report does include an engineering study of a portion of the distribution system of the city of ***. This, however, is customarily found in the preliminary engineering report on a project and not in the construction plans and specifications.

In general, the report could be considered more a description of the project, although there are certain facts and figures that do form a part of the normal specifications.

In regard to the adequacy of the report insofar as specifications are concerned, I might point out a few shortcomings. For example, for the electrical work on the project the report just states it should be of good quality. This is a very indefinite statement. It does not tell the location of the wires, their size, carrying capacity, whether they are to be located in pipe conduits or if BX cable is being used. Nothing is said of the type of fuse protection, the location of the switches, the outlets or lights.

In regard to valves, pipe, etc., no standards are set up for the quality of the material.

Apparently the report plans that the concrete work, excavation for pipes, etc., will be done by local sub-contractors. There is nothing in the specifications, however, to state the type of concrete to be used, the mixture, the water content, no provisions are made for testing and no standards set for testing the concrete so that a sub-contractor could not tell exactly what he was supposed to do.

In regard to the pipe-laying, nothing is said in the specifications as to the soil conditions, the manner in which the pipe shall be laid, the type of joint used or joining material used or the method of back-filling to prevent damage to the pipe. Nothing is said about tamping the soil around the pipe or no method of bracing the pipes at the ends is specified. The specifications do not specify the allowable leakage

in the pipe and no test is specified for determining leakage and whether the pipe and its joints will withstand the pressure necessary. Obviously, unless such underground pipe can withstand the pressures involved there will be a considerable amount of leakage which will be difficult to locate in the future and costly to the municipality if such leakage does occur.

In general, the plans and report would be very inadequate to permit competitive bidding by contractors.

LIST OF 12" VALVES TAKEN FROM JENKINS VALVES CATALOGUE No.76

Iron Body Gate - 125 lbs. steam at 450°F. 200 lbs. Non-shock Cold oil, water, gas.
Page 26 Solid wedge, inside screw, non-rising spindle
Fig. 325, 326 - Price: screwed $125.00 - Flanged $133.00

Iron Body Gate - 125 lbs. steam at 450°F. 200 lbs. Non-shock Cold oil, water, gas.
Page 28 Double-disc taper seat. Inside screw. Non-rising spindle.
Fig. 325 ½, 326½ Price: screwed $170.00 - Flanged $170.00.

Iron Body Gate - 125 lbs. steam at 450°F. 200 lbs. non-shock cold oil, water, gas.
Page 30 - Solid Wedge. Outside screw and yoke. Rising spindle.
Price: Screwed bronze spindle $172.00 - Flanged bronze spindle $180.00
Fig. 650,651 - Screwed steel spindle $160.00 - Flanged steel spindle $168.

Iron Body Gate - 125 lbs. steam press 450°F. - 200 lbs. non-shock cold oil, water, gas, press.
Page 32 Double disc - taper seat. Outside screw + yoke. Rising spindle
Fig. 650½, 651½ - Price: screwed $212.00 - Flanged $212.00

Iron Body Gate - 200 lbs. non-shock cold oil, water, gas. 400 lbs. hydrostatic test.
Page 34 Double disc. parallel seat. Inside screw. Non-rising spindle
Fig. 872, 873 - Price: Screwed $170.00 - Flanged $170.00

Iron Body Gate:- 200 lbs. non-shock cold oil, water, gas.
400 lbs. hydrostatic test.
Page 36 Double disc. parallel seat. outside screw + yoke. Rising spindle.
Fig. 874, 875. Price: screwed $212.00 - Flanged $212.00

Iron Body Gate: 175 lbs. steam at 450°F. - 400 lbs., non-shock cold oil, water, gas.
Page 40 Solid wedge. Inside screw. Non-rising spindle.
Fig. 251, 255 - Price: screwed $185.00 - Flanged $195.00

Iron Body Gate: 175 lbs. steam at 450°F. - 400 lbs. non-shock cold oil, water, gas.
Page 42 Solid Wedge. Outside Screw + yoke. Rising spindle.
Fig. 277, 253 - Price: Screwed bronze spindle $227.00 - Flanged bronze spindle $237.00 - Screwed steel spindle $215.00 - Flanged steel spindle $225.00.

(List continues for two more full pages.)

Competitive bidding for professional services not in the public interest

Nor required by law, courts hold

WILLIAM N. CAREY, M. ASCE, Executive Secretary, ASCE, New York, N. Y.

Recent actions by the commissioners of the highway departments in at least two of our states have served to put an important question squarely up to the engineering profession at least to its civil engineering segment. The question appears to me to resolve itself into whether civil engineer consultants, and civil engineer state and local officials, should abandon their long-held contention that engineering is a profession.

Two state highway departments recently have invited competitive bids from engineers for the furnishing of professional engineering services on certain state highway projects. In each case it was provided that sealed bids or proposals would be received up to a certain date, then opened and reviewed.

Either a bid form or a form of a final contract was furnished by the state, and each engineer was invited to insert in the form his price for furnishing the services outlined. In each case the usual escape clause, generally of no practical effect unless all bids are rejected, was included. It is that the owner reserves the "right to reject any or all bids." It is on this slender thread that some public officials and some engineers base a contention that bids or proposals received are not necessarily judged on a price basis, and therefore, that the procedure does not violate the ASCE Code of Ethics.

Both engineers and public officials know full well that the only purpose of receiving sealed proposals or bids of the kind here discussed is to facilitate a decision based on price, no matter what pious denials may be made. There have been occasions where public officials, even attorneys for public bodies, have been under the misunderstanding that their public works laws or ordinances compel competitive bidding on all contracts concerned with public works. A typical clause in public works laws follows:

> "Every contract or purchase made by the State Highway Department which contemplates the expenditure of more than $1,000.00, shall be let and made after being advertised under rules and regulations to be made and published by the Department."

Under the clause above quoted or some similar provision, public officials sometimes feel they must obtain competitive bids for professional engineering services. Oddly enough, if outside legal consultation is required by these same public officials connected with the same public works project, one never hears that they attempt to engage such consulting legal services through competitive bidding practices. They recognize the law as a profession and they conform to proper professional procedures. They seem unaware that engineering also is a profession. The courts, however, have clearly held that it is.

Not required by law

A good example of how the courts look at competitive bidding safeguards in public works laws and ordinances when professional services are concerned is indicated in an opinion by the Supreme Court of the State of California in the case of Clyde C. Kennedy vs Harry D. Ross, Controller of the City and County of San Francisco. The opinion is identified as "S.F. No. 17,298." In the San Francisco case it was alleged that certain engineering services for the city should have been contracted for after receipt of competitive bids because of the city ordinance requiring competitive bids for things and services costing over a certain sum.

The city engineer's office engaged the engineer under proper professional procedures but the controller refused payment on the grounds that the city ordinance had not been followed. The controversy was carried to the Supreme Court of the State of California. Some of the pertinent phrases in the opinion handed down are quoted below.

While pointing out that the City Charter went to great pains to require that contracts for the *construction* of public works should be subject to competitive bidding, the Court noted that it "does not follow that strict compliance with that requirement must be maintained in procuring expert services to furnish plans and specifications for the construction."

In citing the decision on another case (Los Angeles Dredging Co. vs Long Beach, supra 210 Cal.), the same California Supreme Court stated that "it was recognized that there are exceptions to the requirement

gence and ability to be elected or appointed could be so naive as to believe it could possibly be in the public interest to make contracts for professional services on the basis of competitive bidding. As stated in the Miller vs Boyle California case, "it is beyond peradventure that the lowest bidder might be the least capable and most inexperienced." Or, as in Stephens vs McCammon, where the Texas Supreme Court stated, "to construe the statute contended for (competitive bidding for a professional service contract) would place a premium upon incompetency."

It should be clear that the best engineering service obtainable on an engineering project assures the public of the best results. "Best results" means the best design and construction for the purpose at the least cost. The cost of the engineering service for a project is a very small part of its total cost, perhaps but 4 to 8 per cent of the total. The difference between the cost of construction of a project which is even tinged with bad design or unsound engineering judgment and the contract price for constructing a well designed project can easily amount to several times the engineering fee. Cheap design always means high construction costs.

There are unscrupulous men in the engineering profession as there are in medicine and in law. Our professional licensing laws only partly protect the public from these shoddy characters. Professional codes of ethics in these fields and the manner in which the practitioners of these professions conform or fail to conform to these codes usually serve to set the truly professional men apart from the unethical. In the Code of Ethics of the American Society of Civil Engineers, it is stated that "It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of the American Society of Civil Engineers . . . to participate in competitive bidding on a price basis to procure a professional engagement." This clause does not purport to prohibit competition among engineers nor is there any intent or attempt in our sister professions to prohibit competition among lawyers or doctors. All clearly prohibit competition on a *price* basis, and properly so in the public interest, as has been indicated. Any member of ASCE convicted of violating its Code of Ethics is subject to discipline, even expulsion from the Society, a very serious matter to any truly professional man.

Negotiate with qualified engineers

Competitive bidding is not the way to obtain engineering services. It is practically never adopted by industry, and when adopted by any agency of government, it is usually through ignorance on the part of the governmental unit concerned. The Federal Government is the largest single spender of money for public works, and the Congress is ever alert to provide laws to safeguard the expenditure of public works funds. The Defense Department probably spends most of the federal funds. Regulations of the Defense Department provide that engineering and architectural services shall be procured by negotiation; not through any attempt at competitive bidding. The basic clause in this regulation follows:

"The selection of architectural and engineering firms for the preparation of plans and specifications for public works or for other similar technical and professional services, such as master planning, engineering studies, and investigations, will not be based upon competitive bidding procedures but solely upon the professional qualifications necessary for the satisfactory performance of the services required."

This same principle is followed by the Atomic Energy Commission, the Department of the Interior and its Bureau of Reclamation. The General Services Administration which supervises many other public contracts [sic] the government adheres to this same principle as do most other units of government, state and local.

The detailed procedure recommended by ASCE through which any client should engage professional engineering services is set forth on page 5 of the ASCE Manual of Professional Practice, Manual No. 29. For ready reference, this recommended procedure is quoted below:

"1. From a list of engineers recommended by qualified sources such as other employers or engineering societies, select one or more engineers to be interviewed.

2. Determine which one of the engineers interviewed is best qualified for the particular engagement under consideration.

3. Negotiate with the engineers so selected for services of the nature and extent required.

4. The reasonableness of fees to be charged may be checked with sources of the list considered under '1' above.

5. Engagements involving preliminary investigation and reports should commit the engineer to limiting fees in case additional engineering services are required at a later date on the same project."

This is a clear-cut statement of how negotiation should be carried out. Obviously, if the client and the engineer cannot negotiate an agreement as to factors of time, personnel, price or for any other reason, the attempt will be abandoned and the client will negotiate with another qualified engineer. It is not intended or implied that ASCE recommends that it is in the public interest that the factor of price be *neglected* in such negotiations. It is to be emphasized, however, that the cost of engineering service is but one factor, and a minor one, in the total cost of the project involved. Qualifications other than direct cost of engineering should carry most of the weight in negotiations for professional services.

Points against competitive bidding summarized

The procurement of professional engineering services for public work through negotiation, rather than by attempting competitive bidding procedures, has been pronounced by the courts as being in accordance with our laws. The courts have gone farther and have pointed out that attempts by public agencies to obtain professional services through competitive bidding are not in the public interest. The principal agencies of the Federal Government through which billions of public funds are expended on public works every year, procure professional services through negotiation. State and local governments follow federal practice with rare exceptions.

So-called professional engineering services by licensed engineers sometimes can be procured through competitive bidding. In the rare cases where this practice is resorted to, trouble usually follows. High construction costs follow cheap design—always. In spite of high construction costs, cheap design and its natural companion, bad engineering judgment, may well result in project failure after construction.

Professional codes of ethics exist for two main reasons. One is to furnish a way to warn the public from involvement with professional sharpers or worse. The other is to state fundamental principles of ethics and practice for the conduct of individuals within the profession. The ASCE Code of Ethics prohibits competition *on a price basis*. Public works laws and ordinances do not require competitive bidding on professional service engagements. Public interest is served best when needed professional services are secured through negotiation with qualified professional people who conduct themselves in accordance with their accepted codes of ethics and practice.

that contracts must be let under competitive bidding." The Court further cited a quotation from *McQuillin on Municipal Corporations*, Vol. 2,

"... visions as to competitive bidding have been held *not* to apply to contracts for personal services depending upon the peculiar skill or ability of the individual, such as the services of an attorney at law, a superintendent or architect or a consulting and supervising engineer, and generally the requirement does not apply to the employment of a professional man, in which case the authorities have a discretion as to his qualifications."

The California Supreme Court in this same case very aptly cited another case in point, Miller vs Boyle, supra (43 Cal. App. 39), as follows

An architect is an artist. His work requires taste, skill, and technical learning and ability of a rare kind. Advertising might bring many bids, but it is beyond peradventure that the lowest bidder might be the least capable and most inexperienced, and absolutely unacceptable. As well advertise for a lawyer, or civil engineer for the city and intrust its vast affairs and important interests to the one who would work for the least money."

The Court also pointed out that "The employment of a person who is highly and technically skilled in his science or profession is one which may properly be made without competitive bidding." As might be expected, in the Kennedy vs Ross case, the Court directed the controller to pay the engineer's bill on the ground that the engineer had been engaged in a legal and proper manner.

In many other cases other courts have ruled on this question. For example, there follows part of a report relating to the decision by the Appellate Court of the State of Virginia in the case of the City of Newport News vs Potter (58 CCA 483 1903)

"This case affirms decision of the circuit court for the eastern district of Virginia. Alexander Potter of New York was engaged as consulting engineer to supervise sewer construction. (This firm also designed the sewer). His fee was 6% of the cost. The contractor abandoned the job and engineering services were continued. Potter sued to recover for services. City claimed it could not render itself liable on such an implied contract, relying principally on the clause of the City Charter providing 'All contracts for erection and construction of public improvements shall be let to the lowest responsible bidder.' The court stated 'It seems to us that the services of a consulting and supervising engineer are in the same category as those of a legal adviser.' The provision has no application to the employment of an engineer to supervise the work."

The decision on Potts vs City of Utica (86 Fed. 2nd 616), in the State of New York is another in point. Clyde Potts, an engineer, was retained on a contract to investigate the water company's rates. The court held that the statute requiring competitive bidding was "inapplicable to a contract for professional services . . . where value of services depends on skill with which they are performed."

A Texas case involving engineers and architects has direct bearing, Gulf Bituithic vs Nueces County (11 SW 2nd 309 1929). Here the court said;

"Our courts have repeatedly recognized that contracts of the nature involved in this case, involving special skill and experience, were not within the contemplation of the statute as to competitive bids. It would be ludicrous indeed if a county should publish to the world that it desired to let the lowest bidder a contract to supervise the building of an elaborate road system involving the expenditure of $2 million. In the very nature of things, the legislature in passing this statute did not contemplate that services of this kind covered by the contract in question should be subject to competitive bids."

Not in the public interest

Other Texas cases noted are Stephens vs McCammon -1931 (40 SW 2nd 71), and Stephens vs McCammon 1932 (52 SW Sec 56) (Texas Supreme Court). Here the court said,

"To hold that contracts for this kind of work must be let to the lowest bidder would inevitably result in the county being placed in a position which would require it to accept the services of incompetent persons. Naturally one who has no skill, experience or technical knowledge could under bid one who possesses the skill, experience or technical knowledge to perform this kind of service. In other words to construe the statute contended for would place a premium upon incompetency and produce an unfortunate situation. To illustrate, could it be seriously intended that, if a county desired the services of a skilled and competent attorney to represent the county in some important piece of litigation involving a large sum of money, that the county should, before letting the contract, submit it to competitive bids and then be required to hire the person making the lowest bid therefor? It is plain the legislature never intended that such services should be awarded upon competitive bids."

In Massachusetts, Rollins vs City of Salem (146 NE 795 1925), the city charter required competitive bidding for construction work except in an emergency. It was here held that this provision did not apply to the employment of a consulting engineer, since his was not a contract for construction. A consulting engineer was here employed to determine the feasibility of building a satisfactory school addition for a stated sum. Construction was one thing but the service of the consulting engineer requiring professional skill and judgment was something quite different.

One of the clearest pronouncements on the question was made by a Pennsylvania court in the case of Stratton vs Allegheny County (245 Pa. St 519 1914). In this case the law provided that all contracts should be let to the lowest responsible bidder after reasonable notice. The court said,

"It has never been held, as far as we have been able to ascertain, that the above provisions apply in the making of contracts for the employment of attorneys, physicians, engineers and others involving professional skill."

Reference is also made in this case to Dillon on *Municipal Corporations*, section 1203:

"Scientific knowledge or professional skill has also been regarded as furnishing an exception to the statutory rule. Thus it has been said that the services of a lawyer, of a physician, or of an architect or a surveyor are not embraced within the provision requiring the letting of contracts to the lowest bidder."

A basic concept which runs through many of these and other similar court decisions on this subject is the self-evident fact that it is impossible to obtain truly competitive bids for a service under conditions where the bidders obviously would be bidding on furnishing differing services. Stated another way, unless a definite specification can be written to cover a thing or a service, truly competitive bids cannot be obtained on that thing or service. No man has or ever can write a specification to cover the quality of professional thought or the technical skill and judgment required to assure the success of a surgical operation, the trial of a lawsuit, or the design of an engineering project.

It is true that engineers with questionable professional standards might bid on furnishing the design, plans and specifications for a bridge of a certain length or for similar services covering, say, fifty miles of superhighway. The bids would be based on outlines of the end result desired. Such project outlines, however, no matter how they may be dressed up with details, do not and cannot constitute a specification against which competitive bids can be compared on any other basis than bid price.

It is hard to realize that any public official possessing sufficient intelli-

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APPENDIX III

MINISTRY OF TRANSPORT AND WORKS

Trans works House
P.O.Box 547
Colombo

12th December, 1955

Gentlemen,

Ceylon Aberdeen-Laksapana Hydro-Electric Scheme - Stage 11B

The Government of Ceylon desires to embark, as early as possible, on what is known as Stage 11B of the Aberdeen - Laksapana Hydro-Electric Scheme. I annex a Report by Messrs. Preece, Cardew & Rider of Queen Anne's Gate, Westminster, S.W.1, London, U.K., Engineering Consultants dealing with this stage of development.

2. The Ministry of Transport and Works is not committed to the acceptance of the design of the scheme prepared by Messrs. Preece, Cardew & Rider and desires to examine the merits of any alternative scheme which Constructing firms, who are interested in undertaking the project, may wish to suggest.

3. I am writing to you on the subject as you would probably desire to have the opportunity of offering your services as Contractors for the execution of the work.

4. The precise manner of proceeding with the scheme has not yet been decided. It will be noted that the scheme, as presently designed, calls for a 4½-mile tunnel. The question, for instance, whether the alternative of an open flume to convey the water would be cheaper in cost and is technically sound having regard to the topography of the country and the risk of land slides, in view of the high rainfall averaging 220 inches a year, is a matter which would, of course, require close investigation.

5. I shall be glad if you will scrutinise the Report and inform me

(i) whether any fundamental changes in the design of the scheme for Stage 11B to develop 50 M.W. of electrical power merits examination;

(ii) if so, the nature of such change and what fee, if any, you would charge for a preliminary report with estimate of cost of the work, after inspection of the site, if necessary;

(iii)how long it would take you:

(a) to furnish the report; and

(b) to prepare detailed plans and specifications and tender for the execution of the entire work on the basis of the scheme prepared by you;

(iv) in the event of the basic design prepared by Messrs. Preece, Cardew & Rider being considered the most economical, whether you would offer to prepare, without cost, detailed plans and specifications and tender for the execution of the work; and

(v) how long it would take you to furnish the data and quotations specified in (iv) above.

6. The construction work will be supervised by the Department of Government Electrical Undertakings and a firm of Consultants selected by the Ceylon Government.

7. I should be grateful if you would send me as early as is possible a reply.

Yours faithfully,

Permanent Secretary,
Ministry of Transport & Works

APPENDIX IV

MODEL FORM OF AGREEMENT

Agreement Between a Client and Consulting Engineers for the Design and Supervision of

WORKS OF CIVIL ENGINEERING CONSTRUCTION

MEMORANDUM OF AGREEMENT, made the day of One thousand nine hundred and BETWEEN (Name and address)

(hereinafter called "the Client") of the one part (names) practising as Consulting Engineers at (address) under the style of (name of firm) (who and the survivors or survivor of whom are hereinafter called "the Consulting Engineers") of the other part.

WHEREAS the Client has considered and approved the proposals recommended in a report submitted by the Consulting Engineers, now intends to proceed with the construction of (here describe briefly the proposed work)(hereinafter called "the Works") and has requested the Consulting Engineers to undertake and perform the duties hereinafter mentioned which the Consulting Engineers have agreed to do upon and subject to the terms and conditions hereinafter set forth.

NOW THESE PRESENTS WITNESS and it is hereby agreed and declared by and between the parties hereto as follows:

1. Appointment of Consulting Engineers. The Client hereby appoints the Consulting Engineers and the Consulting Engineers accept the appointment on the terms and conditions hereinafter set forth.

2. Duties of Consulting Engineers. The duties to be performed by the Consulting Engineers are:

A. The preparation in outline of such drawings, estimates and other engineering documents as are necessary to enable the proposals for the construction of the Works to be submitted for preliminary approval by the Client or by the appropriate Government Department or Public Authority, including as may be necessary in the particular case:

(a) A survey or surveys of the site.
(b) Investigation of available data or information relating to the Works.
(c) Advice to the Client as to the necessity for special investigations of conditions of sub-soil, tide or weather and arranging on the Client's behalf for boring tests, trial pits, test piling, models or other investigations as may be agreed to be necessary.

(d) Consultation with any architect appointed by the Client in regard to the architectural treatment of the Works.
(e) The making of such modifications in the outline drawings and estimates of the Works in connection with the consultations aforesaid as may be approved by the Client.

B. The preparation of the drawings and engineering documents necessary for seeking the formal approval of the appropriate Government Department or Public Authority to the construction of the Works and the preparation of all drawings and other documents to enable the Works to be tendered for or otherwise ordered by the Client, including as may be necessary in the particular case:

(a) The making of designs, drawings, specifications and preparing schedules or bills of quantities.
(b) The making or adapting of conditions of contract, forms of tender and invitations to tender and submitting the same for approval and decision of the Client.
(c) Advising the Client as to tenders, tenderers, prices and estimates for the carrying out of the Works provided that no tender shall be accepted or order be placed by the Consulting Engineers except on behalf of the Client and with his authority in writing.

C. The general supervision of and other services in connection with the carrying out of the Works, including as may be necessary in the particular case:

(a) Advising as to the preparation of the contract relating to accepted tenders.
(b) Preparing any further plans, designs and drawings necessary for the carrying out of the Works.
(c) Examining and approving Contractors' details.
(d) Making arrangements on behalf of the Client for the inspection and testing during manufacture of such materials and plant as are usually inspected and tested.
(e) Issuing instructions to Contractors and generally supervising the execution of the Works, including such site visits as the Consulting Engineers consider necessary.
(f) Issuing all certificates for payments to Contractors.
(g) Supervising acceptance tests on site.
(h) Assisting in settling disputes or differences that may arise between the Client and Contractors excepting litigation and arbitration.
(i) Providing the Client on completion of the Works with such record drawings as are necessary for operation and maintenance.

3. Remuneration of Consulting Engineers. The remuneration of the Consulting Engineers for the performance of the necessary services under Clauses 2A, B and C of this agreement shall be calculated as a fee on the basis and in the manner set out in Part I of the Schedule hereto and shall become due to the Consulting Engineers (subject to any special arrangements for interim payments) as follows:

(a) Two-tenths of the fee shall become due when such duties as may be necessary under Clause 2A have been completed.
(b) A further five-tenths of the fee together with the whole of the additional percentage fee for the design of structural steelwork and reinforced concrete shall become due when such duties as may be necessary under Clause 2B have been completed.
(c) The remaining three-tenths of the fee shall become due as and when the work proceeds in proportion to the value of the work certified.

Provided that if the Consulting Engineers shall prepare the contract plans, designs and drawings, in addition to the services under Clause 2A, then one-half of the fee shall become due under sub paragraph (a) and two-tenths of the fee shall become due under sub paragraph (b).

Payments or intermediate payments under this clause shall be calculated on the cost of the accepted tender, or if no such tender has been received, on the best estimate of the cost of the Works at the time payments become due. Such payments or intermediate payments shall rank solely as payments on account towards the total fee ultimately payable and calculated on the Cost of the Works, as defined in Clause 6.

Where fees are based upon the time occupied, the Consulting Engineers shall be paid for work done by themselves and by their technical assistants at the rates shown in Part II of the Schedule hereto.

Payments on account shall be made in such amounts and on such dates as may from time to time be agreed. The final payment shall be made within three months of the completion of the work; should the Contractor's account of the work not be completed by then, payment shall be made on the best estimate of the cost at the expiration of three months after completion, any adjustment necessary being made when the accounts have been completed.

4. Additional Duties. Should the Client require the Consulting Engineers to undertake additional duties such as advising or assisting in connection with:

(a) Obtaining Parliamentary Powers or Ministerial Orders.
(b) Departmental Enquiries not directly concerned with the Works.
(c) The valuation, purchase, sale or leasing of lands or the obtaining of wayleaves.
(d) The making of such revisions as may be required to obtain the formal approval of the appropriate Government Department or Public Authority.
(e) Obtaining formal consents by outside Authorities or persons having rights or powers in connection with the Works or the site thereof.
(f) The making of special or extensive surveys.

(g) Supervising and reporting on model tests or special investigations on sub-soil, tide, weather, etc.
(h) Preparing and setting out details and calculations in a form suitable for submission to any appropriate authority.
(i) Preparing shop details for steel work.
(j) The failure of any Contractor to perform his contract.
(k) Arbitration or other legal proceedings.

then the Consulting Engineers shall undertake such duties on terms and conditions to be agreed between the parties.

5. Out-of-pocket Expenses. In addition to the remuneration to be paid under this agreement the Consulting Engineers shall be reimbursed by the Client all out-of-pocket expenses actually and properly incurred by them in connection with the Works in respect of:

(a) Printing, reproduction and purchase of all documents, drawings, maps and records.
(b) Fees for special professional advice and laboratory investigations as may be obtained by arrangement with the Client.
(c) Telegrams and telephone calls other than local.
(d) Travelling and hotel expenses and other similar disbursements.
(e) Advertising for tenders and for resident site staff, provided that the Consulting Engineers and the Client may agree on an increase in the scale of fee to cover any or all of the expenses under (a) to (e) above.

6. Cost of Works. A. For the purpose of ascertaining the remuneration to be paid under Clause 3 hereof the Cost of the Works or any part thereof shall be deemed to include:

(a) The amount certified to the Contractor, or the amount certified as cost of Works if carried out by direct labor, of Works designed, specified or supervised by the Consulting Engineers, before deduction of liquidated damages or penalties (if any).
(b) A fair valuation of any labor, materials, manufactured goods or machinery, provided by the Client and of the use and waste (including all cost of repairs) of constructional plant and equipment belonging to the Client which he shall require to be used in the carrying out of the Works.
(c) The market value as though they were purchased new, of any second-hand materials, manufactured goods and machinery incorporated in the Works.

B. The Cost of the Works shall not include the following items:

(d) Administrative expenses incurred by the Client.
(e) Payments made to the Consulting Engineers.
(f) Salaries, travelling, out-of-pocket and office expenses of resident site staff.

(g) Interest on capital during construction and the cost of raising moneys required for carrying out the construction of the Works.
(h) Cost of land and wayleaves.

7. Supervision on Site. The Consulting Engineers shall, subject to the approval of the Client which shall not be unreasonably withheld, appoint such resident site staff as is necessary for the efficient supervision of work on site or alternatively shall nominate such staff for appointment by the Client. In either case, such staff shall take instructions from the Consulting Engineers only. The salaries, allowances, travelling, office and out-of-pocket expenses of such staff shall be paid by the Client or if mutually agreed by the Consulting Engineers, but if paid by the Consulting Engineers such payments shall be refunded to them monthly by the Client. The Client shall provide such local office accommodation, furniture, equipment and transport as shall be reasonably necessary for the use of the resident staff. In the event of the Consulting Engineers, with the approval of the Client, not appointing a full-time resident staff for the supervision of the work on site, they shall be entitled to charge for any necessary additional services rendered by themselves and their assistants on a time basis calculated in accordance with the scale in Part II of the Schedule hereto.

8. Damage or Destruction of Works. If at any time before the completion of the Works any part of the Works or the equipment therefor shall be damaged or destroyed by operations of war or other cause, the Client shall pay to the Consulting Engineers the appropriate fee for any additional work which may be required to be designed and supervised by them as a result of such damage or destruction.

9. Postponement, Cancellation or Abandonment of Works. In the event of the whole or any part of the Works being postponed, cancelled or abandoned then the payment to be made to the Consulting Engineers for services performed in respect of that part of the Works so postponed, cancelled or abandoned shall be determined in accordance with Clauses 3, 4, 5 and such other Clauses of this Agreement as may be applicable thereto (with such appropriate adjustments as may be necessary having regard to the services performed prior to the Works being so postponed, cancelled or abandoned). Payments under this Clause shall be calculated on the best estimate of the value of the relevant part of the Works had it been completed at the time of its postponement, cancellation or abandonment. If, at a later date, the Works which have been postponed, cancelled or abandoned or any part thereof are again proceeded with, any payments made under this Clause shall rank solely as payments on account towards the total fee ultimately payable on such Works and calculated on their actual cost. If the whole or any part of the Works is postponed and additional services by the Consulting Engineers are necessary in connection with the resumption of such Works, a fee additional to the amounts payable under Clauses 3,4,5 and other Clauses hereof shall be due, the fee being on a time basis in accordance with the scale shown in the Schedule hereto.

10. Alterations or Modifications to Designs. In the event of circumstances arising which could not have been reasonably foreseen, or in the event of the Client ordering modifications to completed designs or alterations to designs in progress, which require the alteration or remaking of any specification, drawings or other documents prepared in whole or in part by the Consulting Engineers, the whole of the cost of revising, amending or reproducing documents to bring the work up to the stage at which it was modified shall be the subject of additional payment, computed on a time basis in accordance with the scale shown in the Schedule hereto, together with any out-of-pocket expenses incurred.

11. Care and Diligence. The Consulting Engineers shall exercise all reasonable skill, care and diligence in the discharge of the duties agreed to be performed by them and in so far as any of their duties are discretionary shall act fairly as between the Client and the Contractor or Contractors. The Consulting Engineers shall have authority to make minor alterations to design involving minor variations to cost as may be necessary or expedient, but they shall obtain the prior approval of the Client to any substantial modification of the design and cost of the Works and to any instruction to a Contractor which constitutes a substantial variation, omission or addition to the contract.

12. Data to be Supplied to Consulting Engineers. The Client shall furnish all pertinent data and information and give such assistance as shall reasonably be required for the carrying out by the Consulting Engineers of their duties under this Agreement and the Consulting Engineers and the Client shall use all reasonable expedition and despatch in carrying out the provisions of this Agreement.

13. Ownership of Documents and Copyright. All documents prepared by the Consulting Engineers in connection with the Works are the property and copyright of the Consulting Engineers subject to their use by the Client for the particular Works to which this Agreement relates, and the Client shall not be entitled, either directly or indirectly, to make use of such documents for the carrying out of any additional or similar work.

14. Publicity Relating to the Works. In cases where notice or display boards are erected on the site, the Consulting Engineers shall have the right, if they so elect, to have their name, designation and address inscribed on such boards, and to have their name and designation included when commemorative tablets or stones are provided in the finished structure. The Consulting Engineers shall also have the right, subject to the Client's approval, to publish descriptive articles with or without illustrations, relevant to the Works, either on their own account or in conjunction with other parties concerned.

15. Non-assignment. The Consulting Engineers shall not have the right to assign or transfer the benefit and obligations of this Agreement or any part thereof and the same shall automatically come to an end on the death of the survivor of them but without prejudice to the accrued rights of either party against the other under this Agreement provided, however, that it shall be lawful for the Consulting Engineers at any time to take

into partnership another Partner or Partners and that he or they shall thence be deemed to be included in the expression "the Consulting Engineers" where the context so allows or permits.

16. Arbitration. Any dispute or difference arising out of this Agreement shall be referred under the provisions of the Arbitration Act, (.....) or any statutory modifications or re-enactment thereof for the time being in force to the arbitration of a person to be mutually agreed upon or, failing agreement, of some person appointed by the President for the time being of the Institution of (name) Engineers of (country).

IN WITNESS whereof, etc.

SCHEDULE

PART I

Basis of Remuneration

The scale of charges shall be on the basis of....

PART II

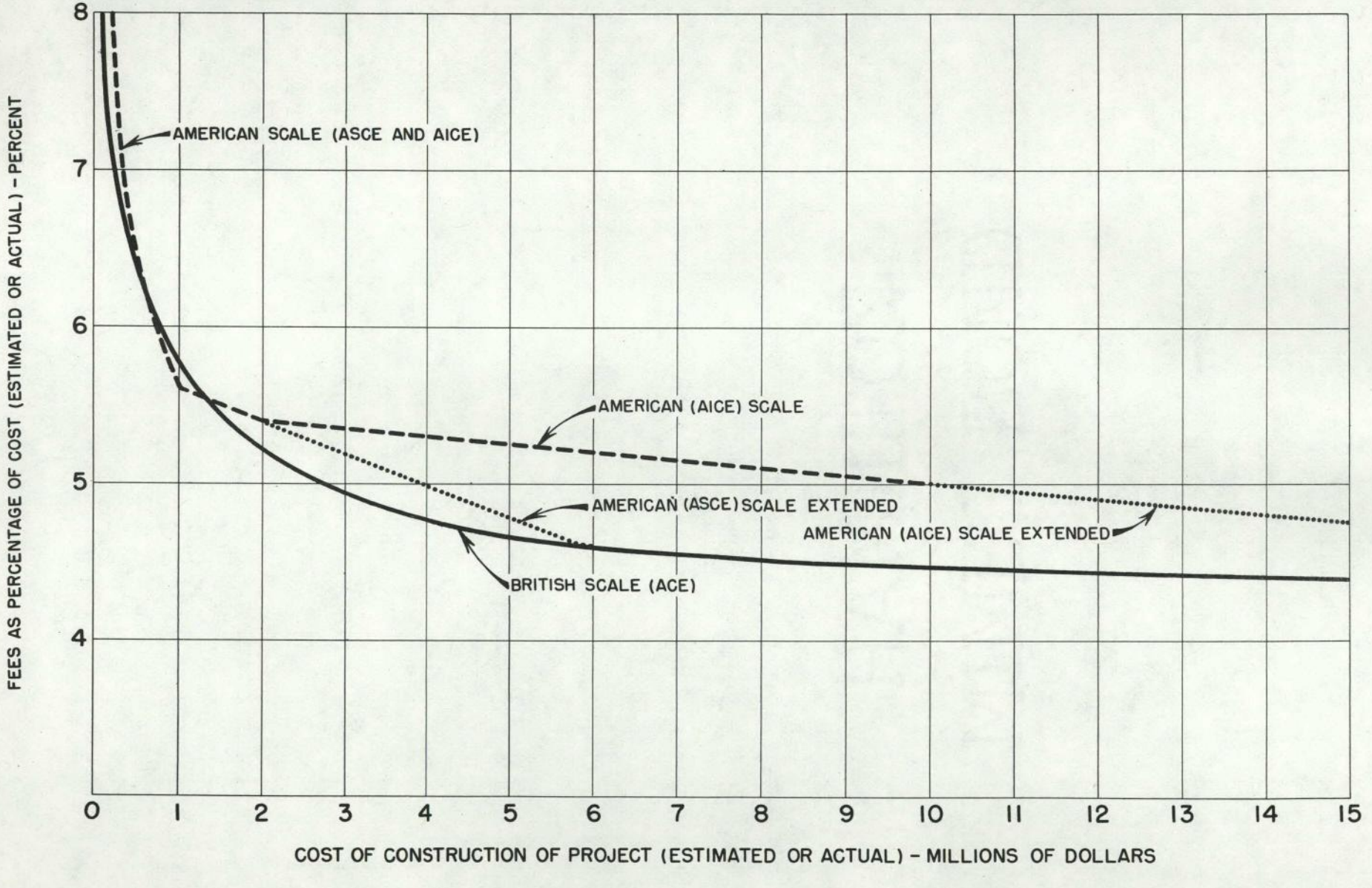
Hourly and Daily Rates

The scale of charges on a time basis shall be as follows:

Time expended by clerical staff (unless otherwise agreed) shall not be chargeable.

Time spent by Partners, Directors and Technical Staff in travelling shall be chargeable.

COMPARISON OF AMERICAN AND BRITISH SCALES



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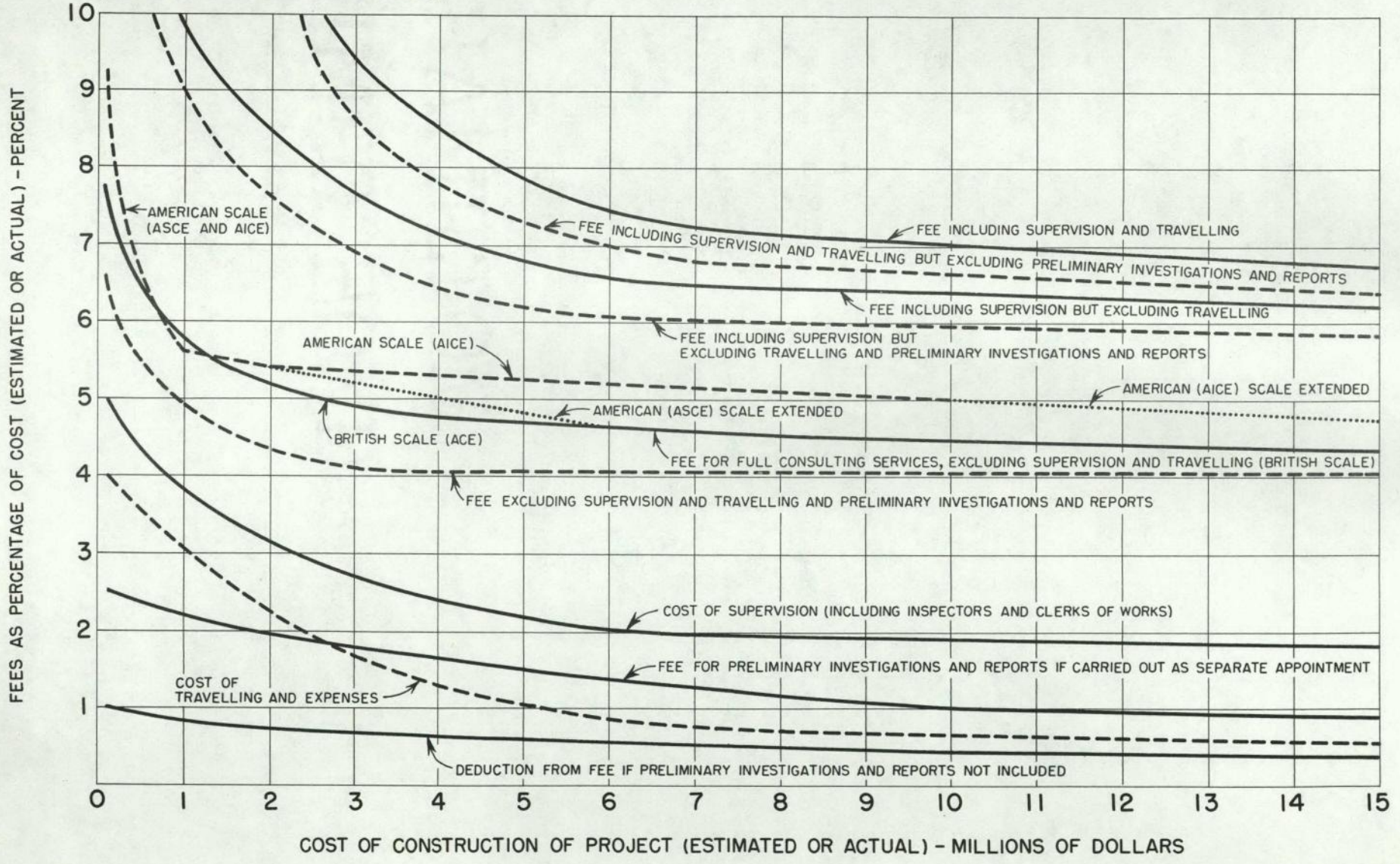
1174

APPENDIX H

ESTIMATED SCALES OF FEES, $ 100,000 - $ 15,000,000

(BASED ON BRITISH SCALE)



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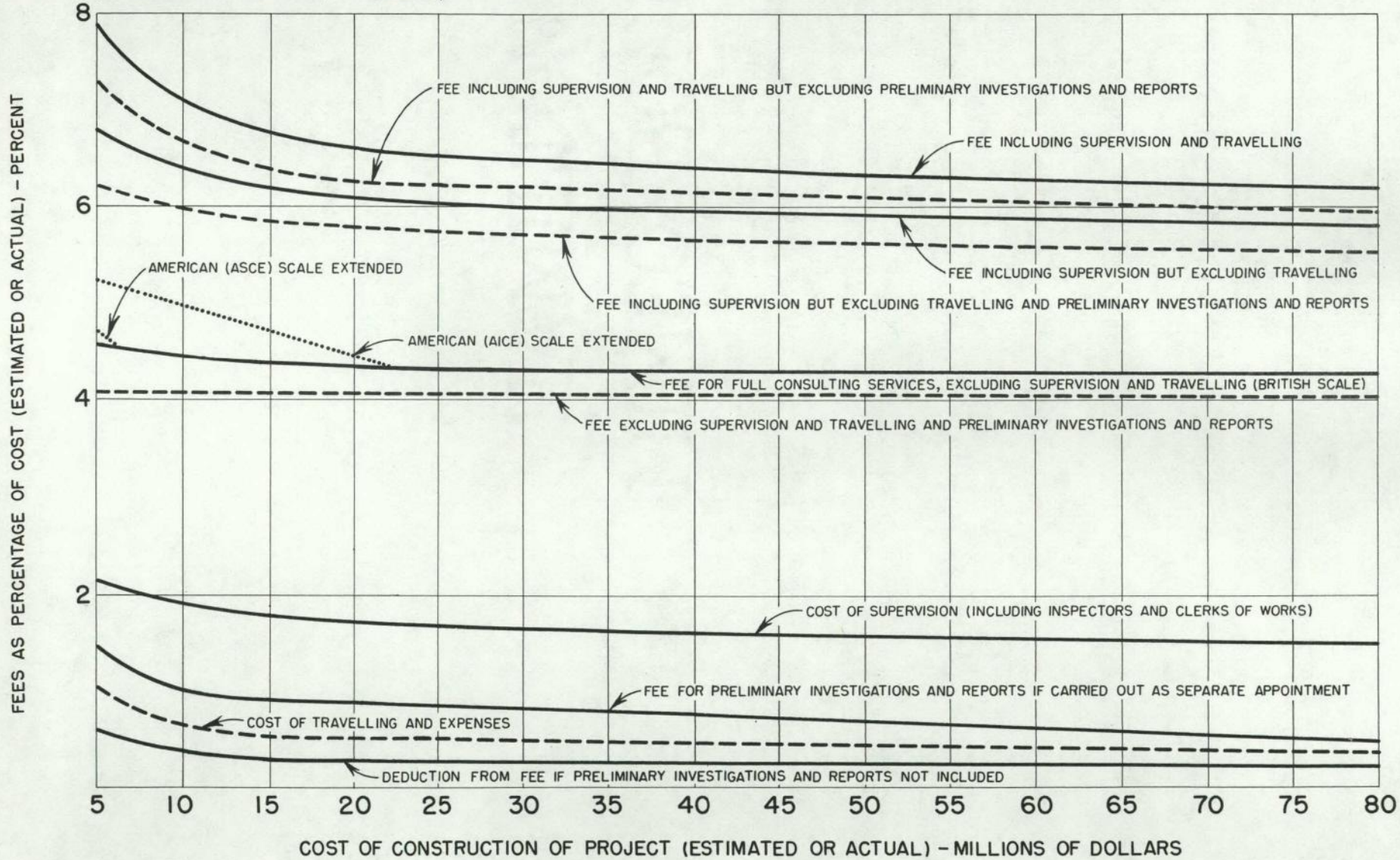
1175

APPENDIX XI

ESTIMATED SCALES OF FEES, $ 5,000,000 - $ 80,000,000

(BASED ON BRITISH SCALE)



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1176

APPENDIX VII

E R R A T A

Background to Procedure on Employment of

Consulting Engineers

prepared by

Mr. Brian H. Colquhoun, Engineering Adviser

June 25, 1956

Page 27, line 2	for '(a)', read '(A)'
" " 3	for '(a) and (b)', read '(A) and (B)'
" " 5	for '(c)', read '(C)'
" 29, " 10	for 'Category (E)', read 'Category (F)'

Engineering Adviser
October 29, 1956

Mr. Herbert Woolley October 24, 1956

Brian H. Colquhoun

Background to Procedure on Employment of Consulting Engineers

In the re-issue of the document "Background to Procedure on Employment of Consulting Engineers", I note that there is an unfortunate error on Page 29, line 10, where the words "Category (E)" should read "Category (F)". As this is rather an important correction, would you be so good as to have all copies still in your possession corrected and perhaps with those already distributed, you could send a correction slip or in some other way arrange for the correction to be made.

There are also some minor typographical errors on Page 27 as follows: - Line 2: (a) should be (A); Line 3: "(a) and (b)" should be "(A) and (B)"; Line 5: (c) should read (C).