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中华人民共和国
工程顾问服务团

8-22 六月 1974

MISSION ON
CONSULTING ENGINEERING SERVICES
TO THE PEOPLE'S REPUBLIC OF CHINA



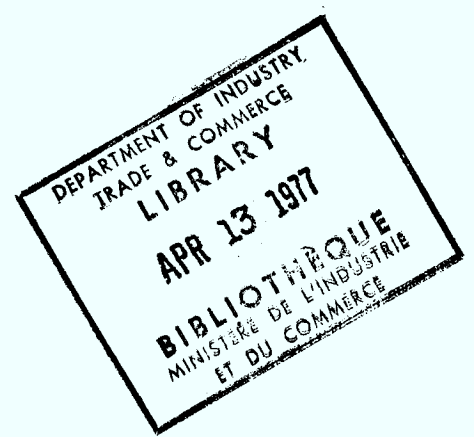
Industry, Trade
and Commerce

Industrie
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访中华人民共和国

工程服务顾问团议谈

北京—1974年6月7日至23日



SEMINAR MISSION ON CONSULTING ENGINEERING SERVICES

TO THE PEOPLE'S REPUBLIC OF CHINA

PEKING-- JUNE 7 to 23, 1974

May 17, 1974

SEMINAR ON CONSULTING ENGINEERING SERVICES

PEOPLE'S REPUBLIC OF CHINA

The Government of Canada greatly appreciates the opportunity of meeting with representatives of the People's Republic of China to discuss the role Canadian engineering consultants can play in the mutual development of our two great countries. We welcome a friendly interchange of technical experiences and ideas. During the coming years, we would also welcome the opportunity for further exchanges for the mutual understanding between our two peoples.

The following chapters reflect the thoughts and experience of some of the most prominent consulting engineers in Canada. They were prepared for the seminar presentation which will follow in the next week. They are intended to provide the background against which our discussions will take place. I know that my colleagues will be pleased to provide any additional information you may require.

中华人民共和国

顾问工程服务议谈

加舒大政府十分欣赏这机会能与中华人民共和国的代表团洽商加舒大工程顾问如何能够使两个伟大的国家相互建设。我们很欢迎友谊性思想上和技术上的交流。将来的日子中，我们希望能有多些机会使两国人民互相了解。

下文都是为下星期议谈所预备定的，文中反影出加舒大首要顾问工程师的经验和见解，是用以对我们以后讨论给予一些背景。我知道我的同志们会更欢喜去供给你们更多必需的资料。

罗爵利

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INTRODUCTION OF THE CONSULTING ENGINEER

by

L.J. Rodger

工程顾问的前题

罗 爵 利

INTRODUCTION OF THE CONSULTING ENGINEER

Perhaps I might use this opportunity to introduce the meaning of "consulting engineering services" to you. In the course of various international discussions, questions are frequently raised as to how to select, establish contacts and conduct relations with Canadian technical experts. Many of the people we talked to lack direct experience in such matters and, in many cases, had to spend considerable time and effort in obtaining technical consultative help for their projects. We hope to be able to show you how engineering consultants can be used by you to provide friendly assistance on resolving technical and other problems you may encounter in your various development programs. We hope to provide you with background information on the selection and effective use of consulting engineering services and to show you the organization of the consulting engineering profession in Canada, the types and scales of fees that are usually paid and the contract forms, etc., commonly used.

First, however, we must define what is an engineering consultant*. The consultant is defined as a person or organization employed by a client organization, on account of his or its specialized knowledge and experience, to act as an industrial advisor or to assume responsibility for action programs or projects. Consultants are professional problem-solvers whose expert knowledge may cover a number of traditional professional fields and who are particularly qualified to undertake an independent and unbiased study of a given problem and reach a rational solution. The value of a consultant lies in his training and previous experience in the solution of related problems and his ability to select the course of action which,

工程顾问的前题

或者我能够利用这机会来介绍一下工程顾问的任务。在各种国际会谈间，很多时候人们都会发出有关如何去选择，接洽和引导加舒大的工程专才。很多时候，跟我们接洽的人都因为缺乏经验因而浪费了很多时间及努力来接纳顾问团的帮助以完成他们的计划。我希望能够指出工程顾问团如何能尽量地被利用於技术上和其它在发展过程中发生的问题上给予友谊的帮助。我希望能够给予你们有关选择和有效地利用工程服务顾问团的背景资料 and 介绍一下在加舒大职业性的工程顾问团体组织，有关他们通常的特点，费用和合同等等。

首先我们一定要解释工程顾问的定义。顾问的定义是某个人或者是某一个团体基於其特别的知识及经验，受僱于另外一个集团以为工业上的顾问或者执行实践计划的任务。顾问们是职业性解决问题的专才，他们的专长可能包括数项专业范围，他们兼且有资格独立地而不偏狭地负责研究已知的有关问题而达到合理的结果。顾问员的价值在乎他的训练，有关问题研究结果的珍贵经验，和在他选择活动途径的

in his expert opinion, should be implemented. There are many types of consulting activities. For the purposes of this seminar, the types of consulting services will be limited to those of engineering consultants who act as advisors on engineering, design, technological, economic, managerial and training problems.

In most countries of the world, the use of consultants has increased considerably during the past four decades. Engineering consultants have contributed greatly to the progress of the economies of many nations and have provided a valuable reservoir of skills and experience to supplement the internal resources of industrial organizations and government agencies. They are recognized as excellent agents for obtaining advice and performing specific tasks, for no organization has a staff sufficiently qualified to find the best solutions to all problems on a flexible basis. The judicious use of consulting engineering services seems to be associated with growth and expansion and is undoubtedly an important aid to development.

Reasons for Using Consultants*

The main reasons for using outside consulting engineers are more or less the same both in China and Canada. The kinds of specialized services needed and the extent to which particular services can be used effectively, vary with the environment in which the client is located. Similarly, the availability of outside advisors, the cost of their services and many other details of the consulting relationship differ greatly. But the fundamental idea of bringing outsiders into a client organization on a temporary contractual basis to render reasearch

能力，这在他专长的意见中，增予一定的功效。顾问活动包括有好几种，为着这会谈的原意，顾问服务的种类只限于工程顾问员，他们专司提供一切有关工程，设计，技术，经济，行政和训练方面的问题。

在过去四世纪以来，大部分国家都大大提高了利用顾问专员。工程顾问专员贡献了很多的经济进展给予不少国家，并供给珍贵的技术宝库和经验以补助国内工业团体和政府部门的资源。他们被公认为优等的提供资料和执行任务的专员。因为在任何团体中都很难找到一位有足够资格在有弹性的范围内解决任何难题而供给最佳结果的人员。明正地利用工程顾问人员似乎是联系着生产和发展，而毫无疑问地对建设有着重要的帮助。

利用顾问的原因

利用外来顾问的主要原因，不论在中国和加舒大都可以说是同样的，需要特别的服务，以至发展到有效的利用服务团，这些都因催主的地区不同而转变。同样地，外来顾问员的供应，费用和很多其他顾问关系的条件都大不相同。但是基本上把外人带进客户团体以当暂时

and advisory services has many inherent advantages. These include:

- (a) The possibility of obtaining specialized skills and know-how;
- (b) The possibility of shortening the time needed for implementation of projects;
- (c) The possibility of finding a fresh approach to established practices;
- (d) The possibility of obtaining independent evaluations and recommendations.

There are a number of sources of consulting engineering services. There is the individual practitioner or professional man of recognized experience and ability who offers consulting services in one or more branches of activity. He may supervise the construction of certain types of plants or facilities, or be an authority on certain sectors of industry, or again be a leading expert in some aspects of management. Frequently, he is a man of vast experience in his particular branch and his name is likely to be among the first that come to mind whenever a particular problem arises. His reputation and standing are largely due to the success of the projects he has undertaken. However, with the rapid advance and complexity of science and technology and the economic implications of large-scale operations, many individual consultants find that their assignments call for experience in fields other than their own, and the tasks can be carried out satisfactorily only by direct collaboration with other specialists. A team is then assembled and a partnership or company is organized. Some organizations, according to their specialties, maintain laboratories and other facilities for carrying out necessary investigations while others subcontract some of their assignments to other firms or individuals.

There are other groups who are not professional consultants

性的研究和提供服务有着很多存在的益处如下：

甲、在可能性内争取特别技术和知识。

乙、在可能性内缩短了工作上需要有效时间。

丙、在可能性内找寻到新颖的途径以确实运用。

丁、在可能性内收集独立估计和推荐。

工程顾问服务的来源有数种。有些个别的人员和被公认为有经验和能力的人都活跃地给予多方占上的顾问服务。他可能专司监督建筑各种工厂和器材，或可能为工业上某方占的专宗，或又会为经营计划的专宗。通常来说，他是一位在他的特长有多方占的经验而他的名字更是在有难题时每为人所首先想到的。他的名誉和地位都是从他以往所执行任务成功中得来的。尤其在利用进步快速，繁杂科技和有效经济的大规模活动，很多个别专宗发觉在他们工作范围内需要别位顾问的经验以便工作在与别些专宗正接合作间得以完满结束。团体合作和公司就此产生。有些团体，因他们的特长，拥有实验室和器材以供研究。有些则以合同分配与其他公司或专宗。

另外有些不是职业性的顾问但认为他们有

but feel they can provide consulting engineering services. These include:

- (a) vendors of equipment,
- (b) suppliers of materials,
- (c) suppliers of proprietary information,
- (d) engineering designers/constructors.

When using these suppliers, the client must bear in mind their inherent self-interest. The main reason for which they offer their services is to secure customers for their products or proprietary information. The Canadian consulting engineer is not directly or indirectly involved with this type of activity and therefore his judgement and professional decisions are made entirely on behalf of his client.

I trust I have given you a brief insight into the characteristics of the Canadian engineering consulting profession.

能力供给意见的，他们包括有：

甲、器材的卖主。

乙、材料的供应员。

丙、财物资料的供应员。

丁、工程师和建筑师。

当利用供应员时，客户应不要忘记供应员以自利为主。他们服务主要原因在乎为其产品或财物资料稳定买主。而加舒大工程顾问团是与这些供应活动毫无直接或间接性的关系，因此他们的推测和职业上的决定都是专为他们的客户设想。

现在我相信我已给予你们一个有关加舒大职业工程顾问团的简短的透视。

THE CONSULTING ENGINEER IN CANADA

by

James W. MacLaren

- Definitions and terminology
- History of consulting engineering in Canada
- Scope of disciplines
- Scope of clients (domestic and international)
- Association of Consulting Engineers of Canada and its code of ethics
- Size and make-up of Canadian industry
- Reasons for using consulting engineers (advantages)

加拿大的工程顧問

麥穎潤

摘要

- 定義和名稱
- 加拿大工程顧問的歷史
- 工作範圍
- 僱主範圍(國內和國際性)
- 加拿大工程顧問會和它的宗旨
- 加拿大工業的大小和成員
- 利用工程顧問的原因及利益

THE CONSULTING ENGINEER IN CANADA

Mr. Rodger has just given you an excellent definition of engineering consulting services. I might add certain additional details as it relates to consulting engineers in Canada. First, to practise in Canada, the consulting engineer must be registered to practise his profession and, in order to register, the professional engineer must have acceptable training and experience. Further, in his practice he acts independently of any organization which may conflict with the engineering services he provides. Either alone or in partnership with other engineers, he devotes himself and his staff to the planning, design, supervision, full project management and/or appraisal of engineering works or matters. For this work he receives remuneration solely from the client for whom he performs the services.

A consulting engineer is authorized to practise under the laws of the province in which he performs his work and he is bound both legally and morally to follow his practice according to a code of ethics of the type demonstrated in Slide #1. The independent consulting engineer cannot be directly or indirectly concerned or have any financial interest in commercial, manufacturing or contracting activities that would influence his judgment in any professional decisions that he makes on behalf of his client.

Consulting engineers have played a significant role in the development of Canada, its resources and the improvement of the quality of life of its citizens. In the consulting engineer's expanding role of service to Canadian public and private institutions, the traditional responsibility for conceiving and designing all types of engineering works and ensuring their proper construction and use still remains as the major aspect of the average consulting engineer's role. The heavy demand for buildings, industrial processes, transportation facilities, environmental control and urban development has been supported

工程師顧問在加拿大

剛才羅爵利先生給你們一個極佳的工程學顧問服務的定義，我可詳細地補充些有關加拿大的工程顧問人員。首先，所有人員一定要註冊才可執業，而註冊成為職業工程師一定要受過認可的訓練和經驗。再者，從事這種職業，一定要獨立服務而不與任何機構有所衝突，不論他個人或合夥工程師，他會和他的手下專心地去計劃、設計、監督整個工程的管理，和鑑定各項工作，他工作的代價是純由他的顧客付予。

工程顧問是經省政府批准，而在法律和道德上，受到道義規則上所限制，像幻燈圖一所示，每個獨立的工程顧問不能直接或間接上受到商業上的利益，制造或包工上的經濟利益而影響他對工程的決策，有損他顧客的利益。

工程顧問在發展加拿大資源和改善民生上有很大的貢獻，工程顧問對公共和私人事業的服務是傳統地負責所有工程，保證所有建造正確，是每個工程顧問的主要職責，在大量需求的建築、製造過程、交通設備、環境控制和城市發展事務，都受到工程顧問奉著傳統法則所

by the healthy growth of the consultant in this traditional role including his increasing strength in project management.

Parallel to this has come the need in Canada to assess the more comprehensive aspects of Canadian development and the requirements to generate new processes and systems to serve the social as well as economic interests of the public. To these needs, the consulting engineer has responded by expanding his firm, in many instances, to provide a more comprehensive multi-discipline service or, in the alternative, to render more specialized sophisticated service.

These strategies have ensured his ability to establish broader and more significant opportunities for his client. He has improved communication and co-operation in his traditional role within the burgeoning construction industry as well as providing creative and innovative solutions to the more complex problems of Canadian society.

The Canadian consulting engineer has also gained significant recognition internationally by carrying out major projects on behalf of international agencies, foreign governments and industrial corporations. The following speaker will provide you with some insight into the scope and nature of projects Canadian consulting engineers have undertaken in other countries of the world. I should note that the Canadian government plays an active role in providing friendly assistance to overseas countries and that the consulting engineering services are used extensively on projects the Canadian governments sponsor.

Conversely, the utilization of Canadian consulting engineering

大力支持，其中更包括加強工程管理。

(加入十二副紅燈片，由第二幅至十三幅是工程顧問監管下的設計和各類工作。)

對加拿大發展有同等重要性的工作有製造新的程序和系統來適合社會和公眾經濟利益有所貢獻，由於各項的需求，工程顧問的反應是擴大他公司的工作範圍，提供更多的服務或給予更複雜和專門化的服務。

(加入八幅紅燈片，由第十三至二十幅，是更複雜和各方面的工程技術的例子。)

這些反應，加強了自己的工作能力，給他的顧客提供更廣泛和重要性的工作，為建築工業更多接觸和合作，提供有創造力和創新的方法去解決加拿大社會的各種複雜問題。

加拿大的工程顧問，在國際上認識了他的重要性，他在國際機構、外國政府和工業機構方面，獲得很多主要工程。下一位講話的人會深入地講述在國外進行的工程性質。有一要要注意的是加國政府非常活躍於給予海外國家友善的援助，而工程顧問的服務被廣泛地利用在加國政府保證下的各項工程中。

相反地，許多國家利用加拿大的工程顧問

firms by exporting countries coming to Canada has provided them a confident and familiar base from which to build their Canadian opportunity.

At the present time, there exist in Canada more than 75,000 registered professional engineers of whom about 10 per cent are employed by or practise as consulting engineers. There are approximately 1,500 consulting engineering firms in Canada today employing a total staff of 26,000 in which 7,500 professional engineers are included. These firms vary in size from organizations employing only one engineering consultant to others employing more than 1,500.

Three hundred of the more significant of these firms are organized under the Association of Consulting Engineers of Canada. The association is a national organization founded 50 years ago under federal letter patent to assist in promoting satisfactory business relations between its members and their clients; foster the interchange of professional management and business experience and information among its members; and safeguard the interest and maintain high professional standards among its members. The Association of Consulting Engineers of Canada is a member association of the International Federation of Consulting Engineers (FIDIC), which is made up of national consulting engineering bodies of some 20 countries, and participates actively in many of its activities. To assist potential clients within and outside of Canada, the association publishes and maintains a directory containing an official list of its member-firms, the addresses of their head offices

來加拿大建立一個有信心和熟知的據點。去開闢市場。(幻燈片第三十六幅至四十七幅。這十二幅幻燈片顯示工程顧問替主之國家在加拿大所做的工作。)

現在加拿大有七萬五千個註冊工程師。大約百分之十是被僱或實施工程顧問的工作。大約有一千五百間工程顧問公司在加拿大。職員共約二萬六千人。其中包括七千五百個工程師。這些公司大小不等。有些只有一個工程師。有些超過一千五百個。

較主要的三百間公司都加入加拿大工程顧問聯會。這是一個國家組織，在五十年前由中央政府特許下成立。目的使刻會員和顧客間的關係更圓滿，有助於會員間交流業務上的管理。事業上的經驗和消息。保障會員的利益和維持高度的業務水平。加拿大工程顧問聯會是國際工程顧問聯會 F. I. D. I. C. 的會員。這個國際的聯會有從自二十個國家的工程顧問組織組成。對各項活動都非常活躍。為了協助有可能性的加國境內或國外客戶。聯會印製和保持一本名錄。列出所有會員公司的名稱，地址，在國內和國外的總公司和分公司。專業的範圍。還有

and branch offices, both in Canada and abroad, their fields of specialization and a summary by firm giving the names of principals, type of specialization, services offered and typical projects. The directory is given wide circulation among existing and potential government and industrial clients both in Canada and abroad.

Today in Canada, the 1,500 consulting engineering firms as a group represent an annual national income of more than \$750,000,000. Consulting engineers have been identified as not only significant leaders in the development of the Canadian economy both at home and abroad and of the Canadian resource base, but as a creditable foundation in the actual economic structure of Canada. This recognition was given official government credibility through the adoption by the federal government of the objectives of the Senate Special Committee on Science Policy now reflected by the current emphasis on "buy" rather than "make" services. Additionally the support to this mission has been provided by the Consulting Services Division of the Special Projects Branch Department of Industry, Trade and Commerce, a division of government directed to the expansion of consulting engineering opportunities at home and abroad.

Disciplines or Fields of Activity

Consulting engineers today carry on practices in all known disciplines or branches of engineering including the usually classified fields. As an example in Canada:

- 57% of all consulting engineering firms work in the broad field of civil engineering;
- 48% of all consulting engineering firms work in the broad field of structural engineering;

各公司簡要地列出了他們的主腦人物、專門的事業、可供給的服務和代表性的工程。這本名錄流通於每一個存在或潛在的政府、在國內和國外的工業客戶。(由第四十八至五十五幅幻灯片顯示這本名錄的價值。)

今天，加拿大的一千五百間工程顧問公司，每年帶來加國七億五千萬元的收入。工程顧問不僅發展加國的國內外經濟和資源，還構成加國經濟結構的一個良好基礎。這是受到政府的讚譽和接納，是議會的特別委員會在科學政策上的着眼點，反映出現時強調購買服務而爭取服務。顧問服務組，一個加拿大政府部門，加拿大工業、貿易和商業的特別計劃支部，替工程顧問服務擴展在國內外的機會。

2. 參與的工程技術

今天工程顧問工程師都繼續使用所知的各項工程學，包括通常的分類科目，以加拿大作舉例：

57% 的工程顧問公司提供廣泛的土木工程技術

48% 的工程顧問公司提供廣泛的構造工程

37% of all consulting engineering firms work in the broad field of mechanical engineering;

34% of all consulting engineering firms work in the broad field of electrical engineering;

14% of all consulting engineering firms work in the broad field of industrial engineering;

5% of all consulting engineering firms work in the broad field of mining engineering.

But the range of service provided today is indeed much more sophisticated than this and requires the disciplined approach of many engineers and other professionals. For example, few firms any longer describe themselves as civil engineering firms or a mechanical engineering firm. Instead, a single practitioner might be a sophisticated specialist in earthquake foundation design or a firm with a staff of 1,500 persons offering services such as:

- electrical utility management
- economic studies, valuation
- systems planning
- generation, transmission and distribution
- power supply studies
- industrial power supply
- industrial plants
- resource and environmental studies

技術

37%的工程顧問公司提供廣泛的機械工程技術

34%的工程顧問公司提供廣泛的電機工程技術

14%的工程顧問公司提供廣泛的工業工程技術

5%的工程顧問公司提供廣泛的採礦工程技術

但服務的範圍，今天可提供的更為複雜，需要更多的各類技術的工程師和專家。例如有些公司再不說是土木工程的公司，或機械工程公司，代替的是一個地震基礎設計專家或擁有一千五百人的公司，提供的服務如：

電力利用管理

經濟研究·估價

系統計劃

發電·傳送和分配

動力供應研究

工業動力供應

工場設備

資源和環境的研究

- water supply studies, waste disposal
pollution control
- agricultural and land use studies
- mine development

The degree of specialization of the Canadian consulting engineer is as sophisticated, as specialized and as multi-purpose as any in the world. Generally, the more specialized the firm the smaller the firm, even to a sole practitioner. Yet this is not necessarily true and even the larger (1,000 to 2,000-employee) firms can provide individual specialist service as well as major design and project management. Canadian consulting engineers are entrepreneurs on behalf of their clients and, like their medical confreres, should their client requirements exceed their own range of disciplines they do not hesitate to enlist the support of other consulting engineering firms more specialized in the area of direct concern.

Typical today of the wide range of discipline capability of the Canadian consulting engineering industry are the following listings taken directly from the discipline listings of the directory of the Association of Consulting Engineers of Canada.

1. Acoustical engineering
2. Aerial photogrammetric interpretation
3. Aeronautical engineering
4. Agricultural engineering
5. Airport and airline facilities

水的供应·安置廢物和染污控制

農業和土地利用研究

發展礦業

加拿大工業顧問的專門化和複雜的程度可和在世界任何一間比美。通常，專業化的公司是比较小的，甚至只有一個工作人員，但這不是一定正確的。大公司（有一千至二千工作人員）也提供個別의專家服務，和主要的設計，工程管理一樣。加拿大的工程顧問人員像醫生一樣，如果顧客所需要的服務是超過所做的範圍時，他會毫不遲疑地去找別家在那方面專門化的公司幫助。

加拿大的工程顧問能做到的工作範圍非常廣闊，以下是從加拿大工程顧問聯會的年錄中抄下來有代表性的例子（舉出五十三種，每種用兩幅幻燈片為舉例，由第五十六至一百六十一幅）

1. 音響工程學
2. 高空攝影解說
3. 航空工程學
4. 農業工程學
5. 飛機場和設備

6. Buildings
7. Chemical engineering
8. Communications
9. Computer technology
10. Concrete technology
11. Process control
12. Corrosion control
13. Dams, bridges, tunnels
14. Earth sciences
15. Economic studies
16. Electrical engineering
17. Electronics
18. Environmental control
19. Fisheries
20. Food processing
21. Forestry engineering
22. Foundations, soil mechanics
23. Geological engineering
24. Harbours, ports and coastal facilities
25. Heating, ventilating, air conditioning and refrigeration
26. Hydraulic engineering
27. Illumination and lighting

6. 建築
7. 化學工程學
8. 通訊
9. 電腦技術
10. 水泥技術
11. 過程控制
12. 侵蝕控制
13. 水壩 · 橋樑 · 隧道工程
14. 地球研究
15. 經濟研究
16. 電機工程學
17. 電子工程學
18. 環境控制
19. 漁業
20. 食物製作過程
21. 林木工程學
22. 地基, 泥土學
23. 地質
24. 海港, 港口和海岸設備
25. 暖氣, 通氣系統, 空氣調節, 冷藏
26. 水力工程學
27. 照明和燈光

28. Industrial engineering
29. Information systems
30. Inspection and testing
31. Irrigation and drainage
32. Marine engineering
33. Materials engineering and/or handling
34. Mechanical engineering
35. Metallurgical engineering
36. Meteorology
37. Mining engineering
38. Municipal engineering
39. Petroleum engineering
40. Plastics technology
41. Power engineering
42. Project management
43. Pulp and paper
44. Railway and rapid transit
45. Recreational
46. Research and development
47. Resources management
48. Roads
49. Sanitary engineering

28. 工業工程學
29. 消息系統
30. 檢查和試驗
31. 灌溉和排水
32. 航海工程
33. 物質工程和搬移
34. 機械工程
35. 金屬學
36. 氣象學
37. 採礦工程學
38. 都市工程學
39. 石油工程學
40. 塑膠工程學
41. 動力工程學
42. 工程管理
43. 紙漿和紙張
44. 火車和快速運轉
45. 娛樂
46. 研究和發展
47. 資源管理
48. 公路
49. 衛生工程學

- 50. Structural engineering
- 51. Surveying
- 52. Traffic and transportation
- 53. Urban and regional planning

Services

Consulting engineering as the term is employed in Canada includes consultation, advice and expert testimony which services can be provided by a sole practitioner or a firm of 3,000 employees. On the other hand, it also includes the provision of extensive and diversified services by engineering firms specially organized for that purpose. As indicated, these firms draw on the combined talents of planners, research scientists, designers technical analysts, specification writers, draftsmen, inspectors, surveyors and other experienced engineers and scientists to carry out their work, including the support from other practitioners in associated fields.

Services offered by consulting engineers may include conducting field investigations; collecting data; conducting public interviews and participation surveys; formulating broad multi-discipline resource and land use development plans or detailed engineering pre-investment reports based on such investigations; furnishing designs, drawings and specifications; securing bids and assisting in the awards of contracts; inspecting construction; testing and approving equipment for acceptance; making appraisals. All of these services may, on larger projects, be

50. 結構工程學

51. 測量

52. 交通和運輸

53. 城市和地區計劃

3 服務

工程顧問這個名詞在加拿大，包括商議、提供和專家見解。而提供服務的是單獨的執行人員，或有三千員上的公司。另一方面，他同樣包括很多公司組成爲同一目的而工作，供給廣泛和種種的服務。這些公司派遣精明的計劃人員，科技研究員，設計員，技術分析，著書方法書員，繪圖員，檢查員，測量員和其他有經驗的工程師和科學家一起共同工作。其中包括有關的執行人員的支持。

工程顧問提供的服務包括實地研究，收集資料，大衆訪問，測量，講述廣大和各方面的資源和土地利用發展計劃，或據調查所得，寫出未授權開發前的工程報告書，供給設計，圖測，指標等來保障投標，有助於獲得合約，檢查建築，試驗和準許儀器的使用，估價和其他的服務。所有這些服務在較大的工程裏，都歸

accommodated under the total service of project management where the engineering firm assumes the comprehensive management of all aspects of a total project from conception to completion of construction and commissioning. On the other hand, the service may be specific such as the analysis and mathematical modelling of a complex hydraulic or electrical system.

The consulting engineer is usually responsible for planning which will commit his client to the expenditure of large sums of money. The value of work to be carried out from this planning and the suitability to the projects intended function must often be accepted by the client at face value if he is unfamiliar with the technical aspects of such work. By their very nature then, consulting engineering services must be carried out in a thorough and efficient manner and in an atmosphere of mutual trust and appreciation between client and engineer.

The consulting engineer who has made the preliminary investigations and planning in a manner satisfactory to his client is normally the best qualified to perform the engineering services in the design and construction phases including full project management. On the other hand, the client may wish to retain him in an advisory capacity while others undertake the assignment.

Clients

Clients who retain consulting engineering firms vary from an individual seeking advice on his property to large corporations, both public and private. Clients arrange for consulting services in view of their possible unfamiliarity with the engineering problem involved or because they find it difficult to employ or obtain an adequate staff of specialists to carry out the engineering works, especially when on completion of

納入工程管理一項，而公司負起一切事務，由概念至完成建造和委託為止。另一方面，所須的服務是很專門的，如以數學來描寫和分析一個非常複雜的水力或電力系統。

顧問工程師通常負責的計劃是須要大量的金錢來進行的，他計劃所需的金錢定要被顧客接納和付去，如果顧客對技術方面和該項工作陌生的話，工程顧問服務，憑着本質，定會全面和有效率地施之，顧客和工程師們在互相樂意和信任下進行。

工程顧問所做的初步研究和計劃，那個令顧客最滿意的，通常是最勝任去設計、建造和整個工程的管理，另一方面，如果他不被錄用，顧客會樂意保留他顧問的身份。

4. 顧客

工程顧問公司的顧客，有個人徵求對自己物業的意見，至私人或大眾的大合作社，顧客安排顧問服務因他對工程問題不大熟悉，或他感到困難去尋找專家和適當的人員去進行工作，特別在完成設計後，處理他職員的問題，在工程管理上，顧客聘請顧問，因為在繁複和工

design the continued employment of such staff no longer can be justified. In project management a client retains a consulting engineer because the complexity and cost of a major project requires adequate control of technology, manpower, time and expenditure to ensure satisfactory operation by a required date.

A consulting engineer's services can be most valuable because of his wide experience with projects and problems of a similar nature but with wide variations in local and operating conditions and because he employs a staff of specialists who can deal authoritatively with the many engineering and technical phases involved. This experience and ability, together with integrity, are all that a consulting engineer has to sell and, accordingly, his reputation rests on the status he maintains in these three essentials.

The decision to utilize government staff or consulting engineers in Canada to carry out a specific undertaking, be it a study, a research program, the design and supervision of construction of an engineering works or full project management, has been established after long experience.

The optimum balance is now considered to be the establishment within government departments of a competent staff for developing policy, implementing and monitoring projects and undertaking the routine procedures. The consulting engineering fraternity is called upon to undertake the "mission-oriented" studies and the full development of non-routine engineering works. This balance maximizes the development of Canada's economy, including export trade development and efficient spending in government.

Private corporations follow a similar philosophy in the retaining of consulting engineering firms except that many of the smaller firms employ a consulting engineering firm in an on-going advisory role since they are not large enough to retain a technical and research staff.

程的費用上，須要適當的技術、人力、時間和費用去確保在一定的時間內有滿意的施行。

工程顧問所提供的服務是非常有價值的，因為他有豐富的經驗在应付同類的工程問題，在各個不同的地方和環境之下，還有他僱用專家來解決種種的技術問題，他的工作能力、經驗，和正直是每個工程顧問所共有的，因此他的信譽和地位也基於以上的三種因素。

在決定利用政府人員或工程顧問，在加拿大去發展特別的事業、科學、研究計劃、設計監督建造工程和整個工程管理已經有了很久的經驗。最適宜的是政府建立適當的人員去發展方針、供給和記錄工程，去做例行的程序工作，而工程顧問卻去擔任每個任務的研究、全面發展，和非公式化的工程，這是最有效率的方去發展加拿大的經濟，包括在入口貿易和政府有效的支出。

私人組織採用同樣的哲理去僱用工程顧問公司，除了有很多細小的公司因為無力維持一組技術或研究人員，須要的時候便僱用工程顧問提供短暫的服務。

Liability and Confidentiality

Previous reference has been made to the competence and ethical performance of consulting engineers. Engineers practising in Canada are professionally liable in performing services for clients in relation to negligence, error or mistake.

Where an engineer contracts to provide services to a client on a project, he is morally and legally obliged to perform his services competently and as agreed with his client. His contract stipulates his terms of performance and, should he fail to adequately perform, his client may sue him for breach of contract. Third parties injured by the negligence of an engineer may seek legal recourse against him under the common law.

Many industrial clients are concerned about protecting the confidential nature of their processing, manufacturing and designs. As a result, most consulting engineering firms will sign an agreement of confidentiality with the client to protect against any breach of confidence. In addition, within the consulting engineering firm itself there are agreements regarding the confidential nature of the interests of clients which prohibit disclosure by individual employees. The signing of such agreements is frequently a condition of employment.

CODE OF ETHICS

The Code of Ethics is to serve as a guide to men of good faith and will not provide detailed rules of conduct for every situation and transgression in the practice of the engineering profession. It will govern in general terms the consulting engineer in his relations with the public, his client and other members of his profession.

5 義務和保密

以上談及的是工程顧問如何有力和正直地推行他的工作。加拿大的工程師是有義務去擔當所有替顧客服務時因疏忽或其他所犯的錯誤。

當一個工程師簽約供給顧客服務時，他在道義和法律上要以他所答允顧客的供給有效的服務。如果他不能適當地完成合約所答允的事項，他的顧客可告發他破壞合約。第三者因工程師的疏忽而受傷亦可在法律上控告他。

很多工業的顧客因心他的製作過程，製造和設計的保密工作。由此，多數工程顧問公司會和他的客戶簽定保密協定來保證不洩漏机密，在公司本身，職員答允不洩漏任何顧客的机密事情。簽定這項協定很多時是被催用的條件之一。

道義規則

道義規則的作用，是給與一個忠實的人的指南。它沒有詳細地說明每一環境下應做和違犯的事。它只管理工程顧問和大眾，顧客及其他同行的關係。

- The consulting engineer, conscious of his responsibilities, will recognize and practise a high standard of moral conduct in his way of life and in the performance of his profession such as to uphold the honour and dignity of the professional body of engineers.
- He will promote the selection for the engineering consultants for assignments based on performance and qualifications.
- He will guard himself against conditions likely to cause death or injury to persons or damages to property and will not allow or approve bad workmanship and faulty material on any work for which he is responsible. He will make known to the proper authority any dangerous action or practice in engineering work that he may become aware of.
- He will only accept to carry out work for which he is qualified in experience and ability.
- He will not allow personal interests of his to affect his decision regarding engineering work he performs.
- He will act as faithful agent of his client in professional matters.
- He will keep confidential all information concerning the business affairs or technical methods of his clients.
- He will avoid being party to any unethical or unjust action on the part of his client and he will advise his client accordingly.
- He will uphold the principle of appropriate and adequate compensation for those engaged in engineering work as being in the public interest and maintaining the standards of the profession.
- He will receive just and reasonable fees for the type of services rendered and the risk taken considering the investment required to develop the skills and knowledge for improved services.
- He will refuse commissions, allowances or gratifications

—工程顧問清楚知道他的責任，認識和嚴守正直的人格，在他的工作上，要保持工程人員所拥有的名譽和尊嚴。

—他會憑著工作表現和資格去揀選工程顧問來担当任務。

—他會避免任何可導致死亡、受傷和破壞財物的情形，亦不容許有差劣的手工，不當的材料在任何工作裏由他負責的，他會告訴有關方面當他發覺工程裏有危險的地方。

—他只接納本身有能力、經驗等資格去做的工程。

—他不會被個人的利益而影响他對工程的決策。

—在職責上他是顧客的忠誠代理。

—他會為他的顧客至商業和技術資料保密。

—他會避免加入任何對顧客不利的活動，而他會適當地通知他的顧客。

—他會保證給予適當的補償，如果是工程需要，但卻有違大家的利益。

—在提供服務和冒險投資在發展技術和知識去改良服務，他只收取公平的代價。

—他會負責的工程裏拒絕任何營造商和供應

from contractors, suppliers or others for work under his responsibility and he will refrain from favouring bidders when the execution of the work is to be awarded by a system of competitive bidding.

- He will refuse compensation, financial or otherwise, from more than one interested party for services pertaining to the same work and he will not use the services of manufacturers and suppliers for free engineering where the work involved is his responsibility and for which he is compensated by the client.
- He will contribute to the progress and advancement of the engineering profession by interchanging information and experience with other engineers and students and contributing to the work of engineering societies, schools and the engineering and scientific press.
- He will refrain from injurious and belittling action toward the professional reputation, prospects or practice of another consulting engineer.
- He will associate in engineering work only with consulting engineers who conform to ethical practices.

商洽的佣金，津貼和賄賂，他在投標時，對所有的投標的人沒有偏袒。

——他不會接受或過一個有興趣的集團的報酬，財政或其他方面去做同一工作。他負責的工作，是由顧客支付的代價，他不會利用製造和供應商來獲取免費的服務。

——他會協助技術的發展，和工程師學生們交換知識和經驗，捐助工程學會，學校和科學文告的工作。

——他不會詭譎，藐視其他工程顧問的名譽，前途和工作。

——他只和其他有道義的工程顧問共同進行工程的工作。

THE CANADIAN CONSULTING ENGINEER IN THE INTERNATIONAL FIELD

by

Marc Benoit

- Canada's reputation in the international field
- The international involvement of consulting engineers and their use by the World Bank, United Nations and others
- The compatibility of consulting engineering with the Chinese doctrine of self-reliance

加拿大工程顧問在國際上場合

彭諾義

摘要

——加拿大在國際上場合之聲譽

——工程顧問在國際上的牽涉及其對世界銀行、

聯合國等之用途

——工程顧問與中國傳統的自信觀念相互容合

THE CANADIAN CONSULTING ENGINEER IN THE INTERNATIONAL FIELD

What brings the Canadian consulting engineer to work in the international field?

The Canadian consulting engineer being, an individual, or a group of individuals, who has gained, during his professional career, valuable experience in specialized areas of engineering or in all its principal fields and who has attained a sound reputation of success in the projects undertaken, goes into the international field because he wishes to make available to others the knowledge and skills he has been able to develop at home and which he feels can be of benefit to those countries considering similar projects to those in which he has participated.

While this altruistic outlook is true, it must be added that the consultant's secondary motive may be that the work he undertakes abroad will also eventually be beneficial to himself and his country as it will serve to broaden his experience and increase his technical know-how. Also, working abroad increases the volume of business handled and, presumably, its profits which constitute, in our society, one of the goals of good administration. It can be considered in some respects as a certain form of expert to which every country or enterprise looks.

These facts are recognized by the Canadian government as well as by the governments of other countries who call upon the Canadian consulting engineer for assistance because there are definite advantages to both be they financial or technical in nature.

The Canadian consulting engineer can offer services for any particular phase of a project up to full project management. In all cases, the client retains the responsibility for all major decisions affecting the project but, at the same time, the consultant relieves him of the work of detailed project

加拿大工程顧問為何活動於國際上？

每一個或每一班加拿大工程顧問，他們在日常工作過程中吸收豐富的工程技術的經驗，同時，他們在工程計劃享有盛譽，那麼當他們進入國際範圍後，就促使他們利用到在本國學到的知識，去幫助發展其他國家的工程科技。

除了上述的主要因素外，其次是他們瞭解到藉著這種機會，可以擴大他們的科技知識及領域，同時亦可以增加貿易，增進收益，這種做法應被視為一個國家良好行政的主要目標，和對外貿易的方針。

事實上，加拿大政府本身與其他國家都紛紛要求工程顧問的協助，因為他們瞭解到工程顧問不單只在科技上有貢獻，在財務計劃方面，亦有明顯的地位。

加拿大工程顧問可以局部或全權負責各種工程企業服務，他們會協助及減輕委託人或國家的科技問題，同時由於他們的科技管理知識包括工作計劃，設計進度，建設等等，亦可減

development which usually results in improved budget cost control because of the overall management responsibility given to the engineer. In fact, when reinforced with management responsibility, the engineering group undertakes the project from the initial feasibility studies through financial management, including planning, design, scheduling, procurement, construction and commissioning. Canada's new multi-million dollar international Airport in Montreal is being handled in this fashion with success as are many other domestic and international projects.

The Canadian consulting engineer is very conscious of the environmental factors involved in the execution of many of the projects in the operation phase as well as in the construction stage. As he has developed an outstanding expertise in this field, the environment will always remain one of his major concerns when undertaking any work involving engineering. This important notion prepares the Canadian consultant to cope with projects on the international market taking fully into consideration the scarring effects of large construction on nature.

Canada's achievements in the international are best illustrated on slide No. 1 which shows the various countries of the world which have used the services of many Canadian consulting engineers throughout the years to execute work in the various fields of engineering. An outline of these achievements is contained in a special brochure prepared by the Canadian Department of Industry, Trade and Commerce.

Generally and for the reasons explained in the introduction, consultations have been given in areas or sectors in which the Canadian consulting engineer has been known to excel because of the successful developments achieved in Canada. The knowledge,

少委託人或國家不適當的開支。例如：加拿大滿地可市興建的國際機場，都是利用這種管理手法，而十分成功。但在任何情況下，委託人或國家應負起一切策劃的責任。

加拿大工程顧問十分著重環境因素，尤其以工程企業操作及工程階段，由於他們在這個工程科技領域素未享有聲譽，所以他們對各種工程實施，更須加倍留意，這種工作的精神及態度，確能令到加拿大工程顧問能夠应付到國際上各種龐大工程企業。

加拿大工程顧問在國際上的成就，可以清楚地從幻燈片上顯示出來。幻燈片上指出世界多個國家利用加拿大的工程顧問，服務於多方面的工程企業。同時，加拿大中央政府之商業部的小冊子亦有明確地敘述他們多方面的成就。

其實工程顧問的成就，亦經過若干艱苦，而他們所得到的經驗，大大減少了國際上各委託人或國家再犯上重複舊轍的錯誤。

sometimes gained painstakingly, forms an experience available to others and saves international clients from covering, perhaps, the same difficult avenues.

The power, forestry, mining and petroleum sectors, etc., for example, are multi-billion dollar industries in Canada.

In forestry, Canada is the world's leading producer of newsprint and the second largest producer of wood pulp, with a logging output of over four billion cubic feet per year. Abroad, this expertise has been in great demand and Canadian engineers have been active in forest development studies and forest related plants and facilities on all continents, from a \$100 million integrated forest products complex in Turkey to Jave Teak development in Indonesia.

In mining and petroleum, Canadian engineers have benefited from the expertise acquired in finding and developing these natural resources to an annual production output of more than \$6 billion. With investment in new installations and equipment exceeding \$1.5 billion annually, Canadian engineers have been instrumental in making Canada the world's largest producer of asbestos, nickel, zinc and silver as well as producing nearly all the minerals needed for the modern economy. This record of success has led other countries to seek Canadian mining engineering services for projects from the 10,000 TPD Cerro Verde copper complex in Peru to mineral exploration in Oman.

The power sector is also a field in which Canadian engineers

在加拿大投資數以億萬元之工業，計有動力部，農林部，礦產及原油生產部等。

在農林業方面，加拿大報紙生產是世界上最其中最大的一個國家，同時，他亦佔世界生產木漿的第二位，他的伐木生產，每年也超過四億立方呎，在海外，這種農林業專家大受需求，而加拿大的工程人員亦積極地發展農林及各種植林生產。他們的事務，計有在土耳其壹萬萬元的連接農林複雜生產，在印尼爪哇的麻栗樹發展等。

在礦產及原油業方面，加拿大工程人員由於技術上發展，每年的生產超過六萬億元，同時每年投資在安裝新的機械，亦超過15萬億元，這樣速使加拿大成為世界上最生產石棉，鎳，鋅及銀等金屬最大的國家，這種記錄生產也使到世界各地到加拿大去尋找工程顧問替他們服務，在秘魯的 10000 T.P.D. CERRO VERDE 銅礦生產，阿拉伯阿曼的礦業探測等，都是明顯的實例。

在動力方面，加拿大工程人員也有十分卓

excell. Their domestic achievements range from the current work on development of the world's largest single generating plant (5,200 MW) at Churchill Falls, Labrador, to the new 850 MW nuclear power plant complex, Centilly I and II, in Quebec. The detailed achievements of Canadian consultants in the power field are contained in two talks that will be given in the technical sessions. For instance, Canada has developed techniques in high voltage transmission lines which now, amongst other developments in the power field, make Canadian consultants ready to contribute efficiently.

In communications, Canada's system is one of the most advanced with three major microwave systems stretching over 3,000 miles to west and a domestic satellite system carrying communications into Canada's northern regions. Abroad, Canadian engineers have been active on such major projects as the East African microwave interconnect system and a 2,100 mile microwave system in Zaire.

Canada's great size has made transportation a vital factor in her economic growth. The development of massive transportation systems has led other countries to entrust Canadian engineers with such major assignments as the Port of Tanjung Priok in Indonesia, the 600-km Katsina-Ala-Biu highway, the Ocean Congo

域的建地。在加拿大本土，最近發展的工程計有位於拉布拉多，邱吉爾瀑布，世界最大發電廠 5200 MW 及在魁北克省，GENTILLY I. II 生產的 850 MW 核子發電廠等。

有關上述二項電力生產情況，在科技議會裏，更有詳細的說明。同時加拿大已有高電壓的傳送系統發展，這種快捷的科技進度，令人瞭解到加拿大工程顧問可以隨時隨地投身於各種科技服務。

在通訊方面，加拿大的通訊系統可說是世界最先進的，擁有微波系統，將通訊傳送到加拿大的北部，在海外，加拿大工程人員亦積極地發展各大工程企業，例如在東非洲的微波互接系統及一個在 ZAIRE 2000 哩長的微波系統等。

由於加拿大有廣大的土地，成為影響其經濟發展的一個重要因素。加拿大龐大的交通系統發展使各國信任他工程人員技術的知識與經驗。例如在印尼 TANJUNG PRIOK 的交通設計 60 哩

Railway and new international airports in Jakarta, Indonesia, and Rio de Janeiro, Brazil.

Canadian achievements in the industrial sector range from highly efficient food processing plants to such massive projects as a \$250 million continuous slab casting facility in Canada. This led to securing contracts for a \$65 million cement works in Algeria, a \$40 million steel mill in England, a \$40 million glass plant in Australia, etc.

In the municipal and buildings sector, such projects as Montreal's new \$300 million sewage treatment plant (one of the world's largest), the \$100 million Royal Bank Plaza Building and Toronto's 1,805-foot Canadian National Tower (the world's tallest) are but a few of the major domestic achievements by Canadian engineers. This knowledge also contributed to the presence abroad of Canadian consultants in this field.

Canadian consulting engineers have, as we have shown in the preceding paragraphs, undertaken and completed projects in many countries of the world. These projects more often

的 KATSINA-ALA-BIN 公路的工程 OCEAN CONGO 火車
路的建造，及在耶加達—印尼·巴西里約熱內
盧的國際機場興建等，亦由加拿大工程人員處
理。

加拿大的工業發展，計有食品調製廠，金
種硬板的鑄造等，而後者每年的生產，超過
2.5 萬萬元。在海外接收到的訂單亦有來自阿尔
及利亞 6.5 千萬元水泥生產合約，在英國 4 千萬
元的鋼業合約，及在澳洲的 4 千萬元合約等
。

在市政及建築方面，例如滿地可市 3 萬萬
元的下水道污物清理計劃（世界其中最大的一
項計劃），1 萬萬元的皇家銀行大廈的建築，
及在芝加哥市 1,805 呎高的 CN 大樓（世界最高
的大樓），都是其中一，兩個实例，顯示出加拿
大工程人員的建設，同時，亦顯示出加拿大工
程顧問在海外的成果。

由以上敘述，我們可以瞭解到加拿大工程
顧問在海外順利地完成他們的工作任務，上述

originate from needs devined and established by each government as a result of long-term or short-term development programs, as the case may be.

Other times, organizations which are off-shoots of the United Nations, such as UNESCO or WHO, undertake projects usually in countries undergoing fast development.

Financing institutions suchas the World Bank also become involved in many of the world's projects and rely heavily on Canadian consulting engineering firms to undertake the work for which they will lend the necessary funds. The fact that these world-wide international agencies call on Canadian consultants is another proof, if need be, of their soundness and reliability in the approach and execution of specialized projects.

The Canadian consulting engineer interested in working outside Canada and particularly outside the North American Continent, has to become known to these organizations as well as to the governments of the foreign couuntries. Registration with many of these world organizations requires the submission of detailed information on the firm's experience as well as that of its principals and has to be renewed at least once a year. This method of work of international agencies, this system of constant scrutiny and appraisal ensures that any Canadian consultant having done work for such organization is reliable.

各項工程，大多是當地政府的長期或短期發展計劃。

有時候，聯合國屬下機構例如 U.N.E.S.C.O. 或 W.H.O. 等會運用發展之國家，進行各項企業建設。

財政機構例如世界銀行也投身於世界各種企業建設，在科技上，它十分依賴加拿大工程顧問公司的協助，而它本身亦以資金支持。同時其他國際代表信任加拿大工程顧問的情況，足以証明加拿大工程顧問確是健全的，可以信任的。因為任何特別企業，他們亦可勝任愉快。

加拿大工程顧問的工作興趣，亦伸展到離開加拿大本土及北美洲大陸，而成為各外國機構與政府所熟識。如果與世界機構工作，顧問公司方面須要向前者登記清楚，同時呈上有關公司的資料和履歷，每年起碼要重新辦理一次，這種方法提選國際代理，更加顯示出加拿大工程顧問的工作可靠性。

Work obtained directly from foreign governments is also a good measure of the international reputation attained by Canadian consulting engineers and their direct involvement in such agreements without the intervention of world agencies implies that they have been able to build up such a reputation. For example, Canadian Engineers have secured contracts direct with other governments without world agencies intervention. A thermal plant was designed by Canadian consultants in Mexico, a pulp mill in Iraq, a university in Saudi Arabia, etc.

Consulting engineering in Canada is generally practised by private organizations which sell technical services to clients for all or certain defined phases of a project such as preliminary and feasibility studies, conceptual design, final design, construction and commissioning, as mentioned before.

But whether some or all the phases listed above are included in the agreement between the client and the consultant, the client remains constantly involved in the decisions which need to be made as work progresses.

When it comes to governments or governmental organizations, one realizes that they usually have the qualified personnel to do the project although the consulting engineer's assistance can be valuable in three different ways:

- 1) By providing temporary technical staff which will not remain on the payroll when the project is complete.
- 2) By investigating and verifying solutions or conclusions arrived at by the governmental staff through independent, parallel studies.

工程直接由外國政府委託加拿大工程顧問辦理而不用過世界代理亦是一個良好工作信譽的證明。例如由墨西哥的熱能廠設計，在伊拉克的木漿廠建造，及在沙地阿拉伯的大學興建工程，都是由素有經驗的加拿大工程人員直接與當地政府接洽而得到的合約。

在加拿大工程顧問公司大多數是私營的。他們以供應委託人或國家各種科技服務，初步和最後的研究，設計及建造等。

無論工程顧問公司與委託人的合約內容是怎麼樣，後者一定是工作決定權的最後決定者。

當談及政府本身或各政府機關，明顯地我們可以瞭解到他們本身已有適當的工作人員，但增加了工程顧問對他們的幫助有下列三端：

(一) 暫時供給工程人員，當工程企業完畢後，就可解僱。

(二) 由於政府與工程顧問分開兩方面進行工程研究，這樣得到的總結，拿出來比較

- 3) By recommending means to solve particular problems or suggesting methods to execute certain projects which then can be verified, approved or rejected by the government technical staff.

In case I referred to above, a project that comes to our mind is the revamping of Montreal's postal facility with the installation of automatic letter sorting machines and optical postal code readers in a modern new building. In addition to the Postal Department and the Department of Public Works engineers who act as project leaders, the consultant, using about 50 engineers and technicians during phase I and approximately twice that amount during phase II, will prepare the final design and the construction of the required facilities. This local group of 100 technicians will not have to become part of the department's staff who will not need to build similar installations in the area.

Thus, for example, if the government of China would like to improve its postal facilities, it could retain as advisors a Canadian consultant experienced in this field who would work with Chinese engineers and technicians to achieve a set goal. Moreover, it is customary in such cases that, for instance, a group of Chinese technicians would work in the consultant's offices in Canada so that, when the job is completed, Chinese people would be in full knowledge and could, if need be, design a similar job for another location in China and, this time, without aid.

，會更加有效和實用。

(三)提供有關解決工作上的困難及辦法，這樣政府便可利用工程顧問提供的資料，協助政府本身的工程人員。

關於上述之第一種情形，最好的例子就在滿地可市修改中的郵政設施。它安裝上新的自動揀信機，並且配合起新的郵政分區編號。在第一階段期間，工程顧問公司須要顧問50位技術人員，但在第二階段期間，人員便須增加一倍了，在這時候，工程人員只不过是技術上的指揮，但他們的職位只是暫時性，當工程完畢後，便可解僱。

假若：中國政府有意改進郵政事務，加拿大工程人員當然可以協助擔任顧問之職，並且與中國工程師及技術人員互相研究，務求達到成果，或許中國技術人員可以到加拿大去與當地的工程顧問一起工作，這樣，當研究工作完畢後，他們便可返回中國，為當地設計適當的制度。

All great nations proceed this way. By exchanging experiences, they attain faster a full proficiency in certain disciplines. For example, it is common knowledge that the excellent Japanese camera trade was initially inspired by German design. Canada, in many fields, is a leader in techniques that it is willing to export through the channel of its consulting engineers.

In case 2, a good example to cite is the development of the James Bay Rivers to produce hydro-electric energy. For a number of years, the Quebec government, through its agency the Hydro-electric Commission of Quebec, made field surveys of the area and collected hydrological data on the five most important rivers on the eastern watershed of James Bay. These government engineers then prepared a development scheme supported by a well documented report.

While the Commission finalized its report, the Quebec government retained the services of two separate consulting engineering groups and asked them to propose their own development scheme based on the information and data collected by the commission field personnel. Their reports demonstrated that the project was economically and technically feasible, but contained major changes that were incorporated in the final scheme adopted. No one has the monopoly of thought and, as the proverb goes, two heads are better than one, so that by combining efforts between government planners and consulting

在界中大國家都是如此。由於交換知識及經驗。在若干範圍內。都可互相得益。例如日本之相機業發展。初期亦受到德國設計的影響。在這方面。加拿大是科技的領導者。而亦願意由這批工程顧問。轉送各種技術知識到外地去。

至於上述之第二種情形。最好的例子莫如現在魁北克省 JAMES BAY 河水力發電計劃。魁北克省政府委託其轄下的電力公司 HYDROELECTRIC COMMISSION OF QUEBEC 經過多年的檢測。收集有關方面的資料。作出一報告。用來支持此工程企業的進行。

另一方面。該省政府又僱用一間工程顧問公司。利用上述所收得集到的資料。讓他們分析後。製造出一份工程大綱。以資比較。其後他們的報告。紛紛顯示此水力發電計劃在經濟原則上及工程原則上都十分合理。但亦須加上若干改善。

俗語有云：「一人計短。二人計長」。政府計

advisors, one becomes more assured of achieving an optimum solution for a set problem. This is more so in hydro-electric development than in any other field, perhaps because the techniques involved are so numerous and because the local conditions are so varied.

In case 3, one can refer to the James Bay development again in which a consultant recommended increasing the quantity of energy produced on one of the rivers by 50 per cent by diverting into it water from part of the bordering watersheds. The Quebec Hydro technical staff undertook a thorough study of the consultant's scheme and eventually concluded the solution to be economically as well as technically acceptable.

The governments of other countries can benefit from an additional advantage in that they can have a number of their own technicians working with the consultant at any stage of the work who thus can gain valuable understanding and knowledge of the consultant's working methods and standards.

We have attempted in this chapter to show that the role played by the consulting engineer is that of a consultant who only studies and recommends methods or solutions to his client which can intervene at definite times during the execution of the projects. The client is called upon and always has the direct responsibility to make the final decision in all matters pertaining to the projects.

All Canadian consulting engineers are independent of suppliers. They do not sell machinery, materials or products but act as prime advisors to clients wishing to complete a project in the

劃人員與工程顧問共同工作，使工程事半功倍，並且可收到預期的效果，尤其以水力發電工程，它須要多方面的科技及知識。

關於上述之第三種情形，魁北克省的JAMES BAY 計劃亦可再引用來做一例子：由於雇用了工程顧問，他們所提供的寶貴意見，包括了一項改善，增加了其中一條河流的發電能量百分之五十。政府水務局人員亦仔細地研究清楚工程顧問的計劃書及採取其中適當的部分。

假若外國政府能派遣人員與工程顧問共同工作的話，那麼，他們便可得益更大，改善工作方法及標準。

本文曾經指出工程顧問的作用是純粹顧問性質，提供委託人或國家工程科技的意見，而後者是他對享有最後決定性的自主權。

加拿大工程顧問是完全不受供應者之控制，他們並不出售機器，材料或製成品，他們只是以顧問身份，運用他們的知識，完成各種工

best way. This independence of Canadian consultants is not unique in the world but is certainly less common than consultants who are somehow tied to manufacturers or suppliers and, thus, cannot offer their client a completely impartial view.

In conclusion, let me state that the Canadian consulting engineer is making his presence felt in the international field. He has on record many achievements in areas where the demand is continuous strong.

The Canadian consultant has shown that he can cope with local conditions being able to adapt his past experience to suit them best. In the case of China, because of the similarity between our countries, vastness, extreme cold and temperate climates, richness in resources, the Canadian consulting engineers can surely and easily adapt their techniques with advantage and benefits to you. As well the Chinese engineers could very well help in solving some of our technical problems. Exchange of ideas through the vehicle of Chinese engineers and Canadian consultants would definitely lead to mutual improvement in techniques and knowledge.

The Canadian engineering firms come from a relatively young but very dynamic and progressive country and have a demonstrated ability to keep abreast of technological changes which, when the occasion arises, has permitted them to innovate when tried and proven methods have proved insufficient.

Confident, as we are, that the past can be a good guarantee

程企業。其實，加拿大並不是唯一的國家擁有這種工程顧問。但十分肯定地說，他們的工作性質與其他顧問不同，因為後者與工廠家及供應者混於一起，這樣會影響他們對委託人提供不偏私的意見。

總括而言，加拿大工程顧問在國際上活動是相當成功，因為他們素來受到各方面之需求及好評。加拿大工程顧問很明顯地表示，他們能夠適應各地方之工作環境，及利用以往之經驗，作為現今之實用。由於中國與加拿大的環境，氣候，礦產等等大致相同。所以，加拿大工程顧問更加會適當地運用其科技，與中國工程人員互相工作，改善一切科技問題。這樣大家便可得益了。

雖然加拿大工程顧問來自一個歷史比較短少的國家，但他們十分精悍，勤勞好學。如果其他科技真正能夠改善工作及生產，他們當然亦樂意接受改革。

無可否認，過往的建樹是日後良好工作表現之最佳保證。假若加拿大工程顧問被邀請及

of the future, we feel that the services of the Canadian consulting engineer will always be valuable to those who may call on his experience and ability.

擢用。我们相信他们一定会力尽所能，将工程做到更佳及更完善了。

SERVICES OFFERED BY THE CONSULTING ENGINEER

by

J. B. Douglas

- The flexibility of engineering consultants
- How services are rendered
 - experience and knowledge of Canadian consulting engineering firms
 - the mechanics of handling a project for a consultant
 - the internal organization of the firm
- Classification of services provided by the consulting engineer
 - consulting services to the client
 - engineering and design
 - purchasing and allied services
 - construction and contracting services
 - planning and research, financial, management and other studies
 - project management
 - special services

顧問工程師所提供之服務 (德歌思)

摘要

1. 工程顧問的伸縮性
2. 如何呈上服務
 - 加拿大工程顧問團之經驗和知識
 - 如何替顧問員掌握其工程計劃
 - 顧問團之組織內容
3. 顧問工程師所給予的服務
 - 催主的顧問
 - 工程和设计
 - 買賣聯繫服務
 - 建築和合同服務
 - 計劃和研究經濟·執行和其他各行學問
 - 工程執行措施
 - 特別服務

INTRODUCTION

"Consulting engineering" as the term is used and understood in Canada, includes not only consultation, advice and expert evidence but also the provision of extensive and diversified services by trained, qualified professional engineers working as individuals or in groups in engineering firms especially organized, operated and managed for this purpose.

The responsibility for planning, designing and supervising construction of all types of developments requiring technical knowledge rests, to a large extent, upon consulting engineers. In meeting these responsibilities, it is the duty of the consulting engineer to ensure for his client that the development facilities are provided correctly, efficiently and economically.

In providing his services as a consultant, the engineer makes available to his client, whether an individual, a company or government institution, a range of trained skills and experience supported by academic qualifications which he utilizes in carrying forward a project from concept to completion.

In order that I may describe in a reasonably specific manner the class of services provided by consulting engineers, I will relate my comments primarily to the field of industrial developments as I believe this will be generally illustrative of the broad range of services provided by consulting engineers in all disciplines.

CONSULTING ENGINEERING SERVICES

The establishment of a new industrial plant, whatever its nature, involves certain administrative, procurement, design and supervisory steps. Their proper combination, which can be called "engineering", governs the technical quality, future operating efficiency and economic return of the plant.

顧問工程師所提供之服務

介紹：

加拿大的「顧問工程師」一語是指一些有經驗的工程師個別或集體地在一些特別工程公司內工作，不但接受外界的詢問並提立意見及經驗上的建議，提供詳細及繁雜的各種服務。所有各類有關科學技術的擴展例如籌劃的職責、設計及工程監督都需要依賴「顧問工程師」，「顧問工程師」的職責是要向其顧客提立正確的經濟及有效的發展之便利。

「顧問工程師」是要提供各種服務給他的顧客，此等顧客包括個別性的、或公司團體、政府機構等。為了更明瞭地解釋「顧問工程師」的各種服務，我將會以我所得經驗作為例子加以解答。

「顧問工程師」的各類服務

凡是需要建立一個新的工場，無論它是屬於何種類的，都涉及行政上的、處理上的、設計上的及監督上的步驟。若以上各步驟能正確地集合在一起，即能支配一間工廠在技術上的品質及未來工作的效率及利益的歸還等。

Since many modern plants require very high capital expenditures, thorough engineering is essential to their economic and technical success.

The engineering service is normally divided into two parts: planning and execution.

Planning

Planning, or preliminary engineering, includes the technical and economic studies needed to determine the feasibility and rentability of a proposed development and to establish a basis for financing it. The planning studies must extend to widely different subjects ranging from purely technical and process matters to those of markets and the supply of raw material. Planning normally consists of the following:

1. Location of an adequate and secure supply of raw material must be ensured. Tests in a qualified laboratory and, in some cases, in a pilot plant or mill, must prove the suitability of the available material for the proposed products.
2. Appraisal of all transportation must be thoroughly performed.
3. Studies of markets, both for domestic and export possibilities, must be conducted.
4. Selection of the process must be made on the basis of the foregoing and preliminary process designs must be developed.

現代的工廠都需要極大的經費。而經過工程的處理而使到它們能在經濟和技術上得到成功。

顧問工程的服务，普通是可以分為兩大部分。一為計劃，二為實施。至於以上之兩大部分，則詳述如下：

工場計劃

工場計劃或論初步工程設計，主要是包括技術上及經濟上的探討決定所提議的發展之可能性，是以便確定其經費。此類計劃普通是包括下列九點：

第一：保證有充份之原料及原料來源之位置，並且保證此等原料是經合法化驗後而可作產品之原料。

第二：估計交通運輸之方便與否。

第三：從事探討國內市場需要及出口的可能性。

第四：基於充份和廉宜的勞工、水源、動力及燃料的供給、運輸方便等等以選擇廠址的地點。除此之外，還要注意廢物的處理、空氣混濁的調節及地理環境。

5. Selection of a plant location must be made, based upon the requirements for adequate and economic labour, process water, power and fuel supply and transportation possibilities. When selecting a plant location, consideration must also be given to effluent disposal and air pollution questions. A specific site must be selected, within the location, with suitable topography and ground.
6. Development of plant arrangement designs must be made in sufficient detail to serve as a basis for capital cost estimates.
7. Production of preliminary inquiry specifications for major equipment to obtain equipment and material tenders.
8. Preparation of capital cost estimates, manufacturing cost estimates and earnings predictions and other financial calculations.
9. Consolidation of the results of these studies in a report.

Execution

Provided that the results of the planning work are positive and encouraging, the client undertaking a new development can then use the planning report for financing it. Once this has been accomplished, the construction of the plant can start. The following administrative, design, drafting and supervisory steps needed to create the plant constitute the execution or project engineering work.

1. Design Development

The size and type of plant must first be confirmed in further detail. Departmental flow sheets and general arrangement drawings are required. Inquiry specifications for all equipment and material are prepared and distributed to prospective suppliers. Their tenders are analyzed and comparison of tender documents are prepared. To minimize spare parts

第六：工廠的設計一定要十分詳細，以便估計所需要的經費。

第七：所應用之儀器及重要的機械，應詳細列其規格以便給予他人投標。

第八：主要費用的估計，製作之成本估計，未來利潤及其它經費之計算。

第九：整理以上各點而作詳細報告。

措施之執行

若上述「工廠計劃」是認為正確的及適合的，而其顧問則可以利用上述工廠設計的報告來尋找經濟的來源。當經濟來源解決之後，工廠的工廠便可以開始建設。隨著管理上的、設計上的及監督上的步驟，而產生了所謂各類措施的執行及各類工程計劃的工作，則又可分為以下各點：

(1) 各類設計

首先工廠的大小及形式需要更詳細的說明。所有工廠內的各部門及普通的廠內佈置更需要有詳細的圖則。所有儀器機件及各類物質的規格，更須預備妥善，以便分別發給各供給商，在工廠內盡量利用同一之儀器或機件作各類

requirements, plant standards are established for such commonly used equipment as motors, starters, couplings, gear reducers, pumps, valves, piping and instruments. A construction budget is then developed by modifying and expanding in greater detail the capital cost estimates prepared during the planning stage.

2. Procurement, Inspection and Expediting

All equipment and material is obtained on the basis of a thorough and comparative analysis of the technical and economic aspects of each item to be purchased. It should be evident that this can be done only if inquiries have been distributed to, and tenders received from, many suppliers. To maintain the scheduled pace of a project, the procurement program must be completed quickly. Inspection and expediting must follow once purchase orders (with confirming specification) have been issued. During the early stages of development expeditors must ensure that the equipment supplier's design work proceeds in such a way that equipment dimension drawings become available in time to prevent delays in the preparation of the engineers' structural designs and in the commencement of the actual plant construction program. Later, inspectors and expeditors, and eventually experienced freight forwarders, must co-operate with respect to adequate packing and despatch of equipment in proper sequence for efficient handling and erection at the plant, yet in sufficient quantities to deserve reduced freight rates.

3. Construction Documentation

More than one-third of the cost of a typical industrial plant is incurred in respect to buildings, civil works and the installation of equipment, all of which is usually provided by one or more contractors, depending upon the circumstances

不同之用途，以便減少多餘的机件。同時工場建設的預算更可進一步的修改及展開，使到在前述的「工場計劃」階段中估計其重要費用。

(2) 儀器、机件等之處理、審查及遞送

各項類之机件儀器及原料都需在技術上及經濟兩方面詳細地加以比較及分析才購買。為了達到上述數目，唯一之辦法是招投些「投標商」，及「供應商」以作比較。為了保持原有的各計劃，能如期完成，這類上述之處理應早完成。當購物的訂單和各類規格發出後，審查及探討的步驟應隨之實行。在早期的階段，負責檢查各類机件儀器的負責人必須預早使各供應商尽早給予各机件及儀器的圖形及尺寸大小，以便給予在工場內設計之負責人有充分的时间設計各類机械之体量而不致耽誤其各種工程的進行。其次負責檢查及接收机件的人員更要互相合作以安排各样机件搬送之先後，以便利工廠之建設。

(3) 整理工場建造的文件

在普通的工業工場的建立，其中三分之一之費用是用於工場的建築和各項机件儀器的裝置。而上述各項工作都分別由一個或多個「營造

in each case. The consulting engineers prepare the pertinent tender documents, including specifications and general conditions of contract. Consultants invite tenders, analyse them, recommend awards and then prepare the final contract documents which govern the work. A wide experience in this sort of thing is necessary if contractors are to be chosen wisely and if the best work is to be obtained at lowest cost.

4. Detailed Design

Concurrently with the earlier stages of procurement and the negotiations of construction contracts, detailed design work is commenced. It usually includes the following:

- i. Detailed site investigations, borings and contour surveys to determine the final and most economic plant arrangement and building foundations.
- ii. The preparation of departmental structural, mechanical and electrical drawings and detailed bills of material, all as required for the procurement of bulk materials and for the efficient field installation of all equipment and materials.
- iii. The control of equipment standards, the compilation of spare parts lists and the procurement of an economic minimum number of spares commensurate with safe operation.
- iv. The progressive issue of equipment and construction specifications, design data memoranda, progress schedules and monthly progress reports.

商」色办，而顧問工程則須要預備各類机件及建築的規格以及合約的內容，然後邀請各「投標商」一起對以上的規格及合約加以分析研討及整理，以便對最後各種工作合約能加以準備，為了務使能夠得到最佳的工作效率和低廉的耗費。對於「營造商」的選擇是需要非常合當及極廣泛的經驗。

(4) 詳細的各項計劃

當在購買机件及儀器的早期階段及由「建築商」商討各項合約的時候，詳細的各項計劃工作亦同時開始進行，此類工作主要色括以下四點：

第一：對廠址加以詳細考察，土地的狀況及地形的勘察等，而決定一個經濟的工場各類佈置及工場的地基。

第二：準備好廠內各部門的構圖及廠內的電路圖，各類所需物資，及各種机件和儀器所需之地方的圖表等。

第三：探查各種儀器的標準，預備一份有關可須各儀器的表，以便購買部門能購買充分的數量。

第四：準備各机件儀器的各類建築的規格

5. Supervision of Construction

The main purpose of the supervision of construction by the consulting engineers is to maintain liaison between the engineers and the construction contractor and to control progressively the quality, cost and progress of construction, thus to avoid the danger of hidden and embarrassing weaknesses showing up late in the program. It is also, in many cases, advantageous for the field supervisory staff to complete the last details of some of the designs and drawings on the site. This staff also carries out progressive checking of all drawings, specifications and other documents and, upon completion of the work, it brings all such documents up-to-date and hands them over to the client's plant administration.

6. Operational Management Services

The consulting engineer may provide assistance to the client in preparation for the start-up and commissioning of the plant and the training of technical personnel to satisfactory levels of proficiency so that optimum levels of production and efficiency will be reached in the shortest possible time. Such assistance may include:

- i. The provision of key personnel as required.
- ii. The establishment of an organization comprising the consultant's and the client's personnel.

。有關於各類計劃的備忘錄及各項進展的計劃和每月的報告。

(5) 對於工場建築的監察

顧問工程師對於工場各項建築加以監察的目的是使顧問工程師和建築商維持一定的聯絡。另一方面更加可以管理各項建築的品質、費用及加強建築的速度等等。此種聯系可使各種隱藏的危險及各種的弱點在後來不致發生。而且在很多種情形下，此類的監察更有助於在建築場地監察的工程師。他們能在現場完成其部份的設計與構圖。這類的工程師更能在現場繼續工作。例如：校對構圖和各種的規格，當此等校對工作完成，更可立即就地轉送給建築商的管理部門。

(6) 各項工場內工作管理的服務

顧問工程師更可協助廠商在新工場工作開始時，例如幫助他們訓練技術人才而使其在短期內有效地生產各項製成品等等。此種的協助可大致分為：

① 供給各部門所需的人才

② 建立一內含有顧問工程師的人員的組織。

- iii. The development of a program of work which will identify the sequence, timing and inter-relationships of management activities necessary for start-up and operation.
- iv. The direction and co-ordination of the preparation of:
 - a. training programs
 - b. instruction manuals for the operation and maintenance of equipment
 - c. policy and procedure manuals where required to define the activities of the organization.
 - d. product manufacturing, raw material and auxiliary material specification
 - e. operating budgets and standards of performance
- v. Participation in the acceptance procedures developed for taking over plant and equipment from the supply contractors.

PROVISION OF CONSULTING SERVICES

General

The efficient performance of each one of the services in planning and executing a consulting engineering assignment requires the combination of a variety of specialists with skill and experience not to be found in a single person.

As an example, based upon my own specialized field of activity as consulting engineer in the forest products field, the following specialists would be employed in the planning and execution of engineering services for a typical pulp and paper project:

Classification

Function

Economists

market evaluation

Foresters

raw material evaluation

Forestry Engineers

Chemical Engineers

process design, environmental
pollution control

③ 建立一工作的程序表及廠內各項部門管理的關係，以致新工場能開始生產。

④ 協助籌備人事訓練的程序，整理各項工作過程及機件保養的手冊及各項工場工作的規則，協助製定各種製成品和原料的規格，及各類工作程序的標準和預算。

⑤ 協助接收各「供應商」所遞送至工場的儀器和機件。

顧問工程師所能供給的服務

能夠使一新工場得以有效的計劃及工作，是需要很多各類不同而有技術及經驗的技術人才而並非單獨一人能完成的，例如我輩人是一位有關森林造紙廠的顧問工程師，據我輩人經驗之談，在一造紙廠所需之特別技術人才如下：

種類	作用
經濟學家	市場之估計
森林學家，森林工程師	基本原料之估計
化學工程師	各項化學過程之設計， 環境空氣混濁的控制
機械，電機，土木，建築工程師	工場之設計及估計

Mechanical Engineers)	
Electrical Engineers)	plant design and estimating
Civil Engineers)	
Structural Engineers)	
Accountants	cost recording and forecasting
Purchasing Agents)	procurement of equipment, material
Expediteurs)	and services
Draftsmen)	production of drawings and specifi-
Technicians)	cations
Clerks and Typists)	
Construction Superinten-	supervision of construction
dents	
Operating Superintenden-	supervision of operations
dents	

The foregoing list of specialists may number more than 200 people in any one large project. The catalytic element bringing together all these specialists into an effective working organization is experienced consulting engineering management.

Internal Organization

In order to bring the specialized services to bear upon a client's project most consulting engineering firms are organized to serve their clients with a combination of staff and line skills.

A staff group will consist of engineers and draftsmen specializing in the various branches of engineering-- civil, structural, mechanical, electrical and so on -- alldirected by a chief engineer. Also in the staff organization are small independent groups responsible for research, technical-economic studies, development and procurement.

A line organization is established for each engineering assignment. It consists of a project engineer, resident engineers and field engineers who are drawn from a central pool. Each

會計師	經濟之收支登記及未來預算案
買手 收貨人員	儀器及各種類物資的購買
劃圖人員 · 技工 · 普通 文員書記	圖則之準備 · 及各類規 格之準備
建築督察司	監督及檢查建築之工場
各項管工	管理成品之製作

上述所列舉之專有人才大約為二百位左右
而上述之人才則構成一顧問工程師的組織。

內容之組織

顧問工程師將一系所需要之人才組成一起
以便為任何一位顧客作其特須之服務。整系列
人約有工程師(土木 · 建築 · 機械 · 電機) · 繪圖
人員，而此等人都是由一總工程師領導和指揮
· 而在此組人員內更再分開很多小組，以便負
責各項之工作。

任何一小組的人都負責一特別任務，此組
人大約分計劃工程師及駐在工場及公司內之工
程師。而在此系列內之人員則需要幫助。此組

such project group serves one project exclusively, but the staff organization serves all projects simultaneously, depending upon the relative demands as forecast from time to time by the project engineers and the partners or senior executives to whom they report. Each project engineer deals directly with the client in matters of detail.

The large consulting engineering organization, engaged as it is upon a substantial number of projects at one time, not only has the key specialists on its staff but can provide the necessary flexibility in the utilization of its personnel. A particular specialist can be diverted at short notice and for a short period from one assignment to another without disruption or detriment to the completion of a particular project.

Consulting engineering firms may exist in either partnership or corporate forms. In either case the professional activities of the firm are directed by a group of partners or senior executives, each of whom is a professional engineer qualified by education, experience and, where the law requires, by statute to practise in his chosen field. These people deal directly with the clients in matters of principle.

Once again, a specific example related to my experience in the pulp and paper field might illustrate the activities of staff and line personnel. In order to carry out the design and engineering work required, say, for a typical integrated kraft pulp and paper mill with a productive capacity of 750 tons per day, it is customarily found that about 400,000 man-hours of professional engineering are required. The project from initial design stage to completion would probably extend over a period of 36 months. In the earlier stages of the project when detail design work is not usually required, the total work force assigned to the project may be only 10 key men, who are provided from the staff specialist group. As designs are developed the line project team is introduced. Major specifications are

內的古人以完成此特別任務。每個計劃工程師需要直接和顧客接洽及研究之作之詳細內容。

普通一個大的顧問工程機構能同時应付很多不同種類的任務。它除了有很多專門的人才外，更能有伸縮性地利用他們的實力。一個特別專門人才能同時应付兩個不同的任務而對其效率完全無損害。

顧問工程公司可以由合夥營業的，或是股份有限公司。但無論它是屬於任何一類，它都需要有一組高級的執行人員。而在法律上他們一定是要符合標準的工程師。他們直接和顧客來交易。

再者基於我本人在造紙廠的經驗，我可以給予一例子以詳細說明一顧問工程師的活動與組織。例如要設計一做紙的工廠，每日造紙量 750 噸。通常來講，此類設計大約需要工程工作的時間為四十萬小時。此類的建造由開始的階段以至完成需卅六個月。在早期的階段，當詳細的設計還未開始時，大約只需十位專門人才便足夠。及後當設計的工作開始進行，這時各類的人員便要介入工作的行列。當各項的規格已定訂，「投標商」亦認為有能實行時，且其他

established and tenders approved, contracts for major equipment are placed and the project engineering force increases sharply; at its peak, it may reach 200, or more. At this stage, some staff specialists may be required for only a few days each month but when required, the need is immediate and they must be quickly accessible to the project group. Such flexibility can only be attained with confidence from within an established engineering organization where personnel have had years of experience working with one another on complex industrial projects.

Method of Operation

At the outset of an engineering project, it is imperative that clearly defined lines of liaison be established. For purposes of co-ordinating the project, it is desirable to form a "steering committee" made up of members representing both the client's and the consultant's organizations, with a nominated representative of the client serving as regular chairman. Such a committee should provide general direction and ensure that lines of communication are open at the various levels of activity. In order to avoid the confusion which invariably results from poorly defined lines of communication, the reporting procedures between consultant and client should be clearly defined and all communications and contact between client and suppliers be through the medium of the consultants in order that he is fully conversant with all aspects of the project development.

To perform his services adequately and ethically, the consulting engineer must associate and identify his interests with those of the client and, in turn, the client must entrust the consultant

主要机件儀器亦搞妥，則此時所需的人員大約能達兩百人或以上。在此階段，有部份專門人才，每月只需工作數天，但他們亦需要隨請即來。此類如此有伸縮性的工作，只有有經驗之顧問工程公司才能做到的。

各類工作進行之方法

在任何任務的開始，各項聯系的計劃一定要預先定好。有時為了任務能更好地進行，更應有顧客和顧問工程公司兩方面派出人事組成一個所謂「領導小組」，如能令顧客所派出之其中一員為主席更佳，此小組需給予各階層人員各方面的指導和消息，使他們能互相保持聯絡。為了避免混亂起見，顧問工程公司顧問的聯絡，一定要很有系統，而顧客和供應商之聯絡和接洽，應以顧問工程公司作中間人，而使到顧問工程公司能對於其任務能隨機應變。為了使工作又服務能適當地進行，顧問工程公司應向顧客指出其公司之各項主要服務，而顧客對於顧問工程公司亦應完全信任。

為了要使其服務進行得快捷妥當，顧問工程師一定要確定聯系與業主間之興趣，而同時

with all pertinent information bearing upon the assignment and likely to affect its efficient execution. This relationship of trust is guaranteed under the codes of ethics subscribed to by consultants in various jurisdictions. These codes are enforced by accredited professional organizations or associations empowered to revoke the right of the consultant to engage in practice.

It may be summarized that the consulting engineer becomes a part of the client's organization in a sense similar to that of the client's own employees for purposes of completing the assignment. By contrast, the relationship between the client and an equipment supplier or construction contractor is essentially a commercial relationship.

Despite the extent of the consultant's qualifications and experience which may well be greater than those of the client, he is always, during the assignment, subject to the direction and the decisions of the client. In discharging his responsibilities, the consultant can only counsel the client on a particular course of action. It is his duty to state his recommendations forcefully and persuade the client with respect to processes, types of equipment or choice of contractor, but in the ultimate, the client is under no obligation to accept such advice and can instruct the consultant as to the final action to be taken.

Professional Nature of Services

The professional nature of the consulting engineer's services cannot be emphasized too strongly. Clients can be properly served only if the consulting engineer's judgment is completely independent of commercial considerations. It is for this reason that consulting engineers cannot be involved, either directly or indirectly, in the manufacture or sale of equipment or in contracting. Actually, the consulting engineers are the client's agents, directly representing the client's interests

僱主需得信任工程師的直接資料，俾得其發揮至大的功效以完工。這種信任兼由工程師呈上僱主以備受法律上明文担保。這些條文都受工程顧問組織及協會所大力支持以正工程師的實施權力。

總括而言，顧問工程師會像其顧客之顧員一樣為其顧主服務，但相反來說，顧客與那些儀器机件供應商及建築商則祇有商業上的關係。

雖然顧問工程師對於其任務往往比其顧客有更多的經驗和資力，但其任務的決定性仍在顧客身上。顧問工程師一定需要詢求顧客的同意，才能實踐行動，對於各種儀器的選擇，投標商及建築商的選擇等，顧問工程師應負責向其顧客提出及說服各種意見，但顧客有權加以反對，而且可作最後各種行動的決定。

顧問工程服務不能完全独立的，顧問工程的決定全不需顧及商業性的考慮時，顧客便會得到正當的服務。基於上述的原因，因此顧問工程完全不能介入產品儀器机件的買賣或商業上的合約。事實上，顧問工程公司是相當於顧客的代理商，而他們無形中代表了顧客的各方

in all matters and as such they cannot, at the same time, be doing business with the clients. Nevertheless, because they are independent professional people, consulting engineers are very often the equipment suppliers' and contractors' best guarantors of fair treatment.

CONCLUSION

The development of engineering expertise is strongly influenced by the environment in which it is acquired. Canada is a young country by the standards of social and industrial development applying to the highly industrialized countries of the western world. This vast country, embodying large areas of formidable terrain widely subject to a cold and inhospitable climate, is richly endowed with natural resources and is occupied by a relatively small population. These factors have provided the environment in which Canadian consulting engineers have developed their particular knowledge and experience.

Because of the particular nature of Canada's development, her engineers achieved early recognition in such fields as transportation, communications, generation of hydro-electric power, mining, forest products and the development of petroleum resources. The great improvements in international transportation and communications, which commenced 25 years ago, added a new dimension in that consulting engineering could readily be practised on an international scale. Canadian consulting engineers have participated extensively in world-wide activities, gaining perhaps unique experience in the field of international engineering, and have expanded the skills and knowledge available to their clients through broad exposure to, and growth in understanding of, the problems and people of other nations.

From this background I should like to express my belief that Canadian engineers are well qualified to assist and counsel the Chinese people in the application of modern engineering technology and in a manner similar to that practised with their Canadian clients.

面的利益。因此他們不能同時向顧客作各種商業上的來往。由於顧問工程是獨立的，無形中他便成為各「儀器供應商」及各「投標商」在各方面能得合理待遇的保證人。

總論

工程人才的發展完全在乎其環境上需求所影響。與西方國家在社會及工業上的比較，加拿大似是一很年青的國家。她的天氣寒冷，地大物博而人口不多。以上各種的因素而構成加拿大的顧問工程特能發展他們持有的經驗和知識。

由於加拿大的特有自然環境，最有成就的工程包括交通、電訊、水力發電、礦產、林業及石油。早在廿五年前由於交通及電訊普及世界性，而使加拿大的顧問工程能符合國際水準。加拿大的顧問工程常與國際有密切的活動，因此他們對於外國的顧客及各項問題以及其國民都有深切了解和認識。

SELECTION OF A CONSULTING ENGINEER

by
Norman D. Lea

- Define the engineering need or problem
- Organization and policy to select a consultant
- Preparation of lists of consultants
- Engineering submissions or proposals and selection board
- Terms of reference and regulations in the selection procedure
- The consultant's approach to resolving client problem
 - their experience, knowledge and reputation
 - personnel
 - similar projects
- Preliminary screening and negotiations
- Suggested procedures

There are a great many consulting engineers in the world. Some international agencies that regularly employ consulting engineers have the names and details of more than 10,000 of them on file. It is, therefore, not a simple task to select the best consulting engineer for a particular undertaking. There are many wrong ways of making the selection.

Possibly the most notoriously wrong way of selecting a consulting engineer is through a public or semi-public tender call with the selection being based on the lowest bid in the same way that one might purchase steel piles or any

遴选顾问工程厂商

李若曼

摘要

说明工程要领或问题。

遴选顾问的组织和方针。

开列顾问名录。

工程建议或提案和遴选会。

遴选程序中的推荐条件和规则。

审查顾问厂商所提出的方案。

—经验，知识和信誉。

—人员。

—类似工程。

初步审查和洽商。

遴选程序拟案。

世界上有成千上万的顾问工程师。某些经常雇用顾问工程师的国际性机构，存有为数多达 10,000 位以上，各工程顾问的详细档案。因此要为一宗专案选出最称的顾问工程师，确实不是一件简单的事情。有许多选择法是错误的。

最不智的方法，莫过于举行公开或半公开的投标，然后选择标价最低者承办。这种方法，犹之于购买钢料，或者其他货品一样。（它

other commodity which can be completely and precisely defined by a set of specifications.

Table 1 shows the prices tendered in one such semi-public tendering recently in an African country.

TABLE 1

PRICES BID BY CONSULTING ENGINEERS
FOR ROAD DESIGN AND SUPERVISION PROJECT IN AFRICA

Consulting Firm

#1	Location	Design \$ 000	Supervision \$ 000
1	Karachi	792	330
2	Cairo	1155	416
3	Belgrade	1172	561
4	Rome	2111	2171
5	Toronto	3188	3947
6	Rome	3222	1620
7	Paris	3234	1584
8	London	4455	2508

The project referred to in Table 1 is the design and construction supervision of a highway 550 kilometres in length which is expected to have a capital cost of about 60 million dollars. The total cost of good quality design and construction supervision of such a project is unlikely to be less than 10 per cent of the construction cost. It is obvious that some of the firms have quoted a price at which it is impossible to provide high quality services. It can be absolutely guaranteed that the low bidder in this instance would not be the best choice to undertake the work. Indeed, the owner

们的品质，可以靠规格而明确规定的。)

第1表陈示最近在北非洲某国举行半公开
投标的标价表

第1表 非洲某国设计和监造道路顾问
工程团标价表

顾问团	团址	设计	价(单位:千元) 监造
1	KARACHI	792	330
2	开罗	1155	416
3	BELGRADE	1172	561
4	罗马	2111	2171
5	多伦多	3188	3947
6	罗马	3222	1620
7	巴黎	3234	1584
8	伦敦	4455	2508

第1表所指的工程是设计和监造一条550公里长的公路。它的成本估计大约为6千万美元。承接这项顾问工程，如果要办得好，它的总成本大致不会低于工程费的10%。因此第1表所列出的标价中，有些投价太低，显然无法做出来高品质的工程。所以“择廉而与”是根本行不通的办法。事实上，假定某客户一定要这

of the project would certainly be involved in no end of difficulties if he were to accept the low bidder. If he were to persist in this type of procedure for selecting consulting engineers, he would soon find that competent firms would not even submit a proposal.

The objective of this paper, of course, is not to catalogue the wrong ways of selecting a consulting engineer, rather it is to suggest the best way of doing it.

The best firm for a particular project will be the one which most excellently fulfills all of the seven criteria listed in Table 2.

TABLE 2

Criteria to be Satisfied by the Consulting
Engineering Firm Selected for a Particular
Project

1. The firm shall have a record of consistent success in completing projects on time within budget and to the satisfaction of its clients.
2. The firm shall have substantial experience which is directly relevant to the project.
3. The firm shall have available, for assignment to the project, staff who possess the required skills and experience.
4. The firm shall have developed for the project a technical approach and methodology which is excellent.
5. The firm shall have adequate financial strength, Backup staff and other resources to overcome unexpected difficulties.
6. The firm shall possess knowledge of the conditions surrounding the particular project and a special interest in that project.
7. The firm shall contract for an appropriate price.

The creteria listed in Table 2 are more or less in order of importance and they are to a considerable degree self-evident.

样办，它必定是困难重重的。而且能干的公司也会从此望而止步。再也不来参加投标了。

当然，本文的目的不是要分门别类地列举出来错误的方法，而是要关于正确的方法，略为提出一点管见。

第2表开列出来七项标准，最能满足这些条件的顾问厂商，便是最佳上选。

第2表

顾问工程厂商评定标准表

能在预算之内，如期完成工程，并经客户满意，有纪录可查者。

与目前工程有直接关系，富有经验者。

拥有足够的人材，并具有经验和技能，可以派往工地作业者。

能为本工程特别提出有效的技术和方法者。
有适当财力，后备人材，和其他后备力量，能克服不及料之困难者。

能了解本工程四周环境和条件，并且对于本工程具有特别兴趣者。

标价合宜者。

第2表所列举的标准，大致是按重要顺序而排列的。最重要的一点是，遴选程序要求能

It is important that the selection process be such as will effectively discover and select the firm which does indeed meet these criteria in the most satisfactory fashion. Sometimes there will be some additional qualifications such as the ability of certain key members to communicate in a specific language.

The seven general steps in the selection of a firm of consulting engineers are listed in Table 3.

TABLE 3
Steps in the Selection of a Firm
of Consulting Engineers

1. Define the project.
2. Select a long list of firms.
3. Investigate the firms on the long list.
4. Select a short list of firms.
5. Evaluate the firms on the short list through proposals (unpriced) and/or interviews.
6. Select one firm.
7. Negotiate a contract.

There are special circumstances in which some of these steps may be omitted. For example, if a client has had experience with a particular firm and finds that firm's services to be eminently satisfactory for a particular type of work, then it is quite natural and proper and the very best procedure that a new project of the same type will be given directly to the firm which has proved itself. In this instance, steps 2., 3., 4. and 5., would be omitted. In the absence of such experience, however, it is usually desirable to proceed through most of the seven steps.

Defining the Project

The first step in all instances is a clear definition of

选出来一个厂商，最能满足上列标准。有时也有格外的要求，例如主要负责人员能够通晓某种语言等。

第3表开列出来选择顾问工程厂商的七项步骤：

第3表

确切定明工程内容。

详细开列一张厂商名录。

调查上列厂商。

缩编一张短的厂商名录。

邀请上项所列的厂商提出工程案（不列价）。

然后加以评定。或约期面谈。

选定一个厂商。

合约议价。

在特别情形之下，上列某些步骤可以省去。例如，顾客知道某个厂商对于某种工作特别胜任，那么遇有同样的工作，自然直接交给该厂商承办。于是2-5步便可以省去了。如果顾客无此经验，那么通常就以按照上列七个步骤实施，比较合适。

定明工程内容：

无论在那种例案，第一步总是把工程内容

the project. The objectives, scope and terms of reference of the project should be reduced to a clear, precise written form. In this connection, the project will be classed into one of the four categories of projects listed in Table 4.

TABLE 4

Classes of Consulting Engineering
Projects

1. Policy and management projects.
2. Project feasibility and preliminary design
3. Design and documentation projects.
4. Supervision or management of construction.

There are a great variety of policy and management type of projects which are given to consulting engineers. These include planning and program development, the supply of management staff, trouble shooting, the evaluation of management staff, trouble shooting, the evaluation of facility performance and management, studies of organization and staffing and the development of training and other programs to overcome difficulties. Because of the great variety of the policy and management projects, it is necessary to spell out the objectives and scope of particular projects with special care and precision.

The objective of project feasibility studies is to determine whether or not it is indeed feasible, from a physical and/or economic or other point of view, to carry out a project. It is usually desirable as part of a feasibility study to carry out preliminary or conceptual design and to compare major variations in a project so that the result of the feasibility study is the comparison of several significant alternatives or variations.

Design and documentation is the preparation of the detailed design and of the drawings and specifications which are used for construction.

确切定明出来。目标，范围和推荐条件等都要明晰精确地写出来。关于此点，一件工程可以归属于下列四种之一，如第4表所示。

第4表 顾问工程分类表

政策和管理工程。

研讨工程的可能性和初步设计的工程。

设计和制备文件工程。

监督或管理营造的工程。

关于政策和管理工程，又可以细分为许多种。计有：计划和制订进度表，供管理人员，检察故障或疵漏，评定设备工况，和评估管理系统，研究组织人事，并建议发展训练或其他计划。因为政策和管理工程范围太广泛了，所以关于某宗工程，必须把它的目标和范围谨慎精确地写出来。

研讨工程可能性，其目的是判定某宗工程从实际的或经济的或其他的观点来否定开办。通常实施初步设计（或称概要设计）用来比较工程中各样变异因素。然后择定几种重要变量，由此判定某宗工程的可能性。

设计和制备文件是制备详细设计计划，画图，和规格表。供营造工程之用。

Supervision or management of construction is the overseeing of the construction of the facility.

Selecting a Long List of Firms

One widely used method of developing a long list of candidate firms for international projects is simply to write to the embassie of countries which would be expected to contain the right sort of consulting engineers or write to the consulting engineers' associations within these countries. One may also obtain suggestions from international agencies such as the World Bank and from other purchasers of consulting engineering services which have had experience in the particular area.

The long list should comprise the names of approximately 12 consulting engineering firms.

Investigation of Firms

One of the most important steps of the whole process, and which must precede the selection of a short list, is the investigation of the firms whose names appear on the long list. It may be time consuming to execute this step well, but it is very much worthwhile. The first place to go to get information about the firms is the firms themselves. Write to them explaining clearly that they are not being requested for a proposal, but that they should only supply a one-page letter of interest, their standard printed brochure and a list of similar projects which they have undertaken with the names and addresses of the clients for whom they have undertaken this work.

The next step is to write to the clients for whom the particular firm has carried out work and to ask the individual client if he is able to recommend that firm for other similar

監督和管理營建的工程是實地監督設備的修建。

制備廠商名錄

為某宗國際性的工程而制備廠商名錄，最常採用的辦法便是先打聽出來某國可能有那種顧問工程廠家，然後寫信給該國大使館，或者給該國顧問工程師協會，索取名單。也可以向國際性的機構諮詢。例如世界銀行等。或向已經雇用過顧問工程廠家的單位詢問。這張名錄大約應當包含12家廠商。

調查上列廠商

本步驟是全部步驟中最重要的一步。由此可以縮編出來一張短的名單（見下）。實施本步驟也許很費時間，但是是值得的。為要獲得所需的資料，第一步便是寫信給該公司。信上要清楚說明現在並不是要求他們提出方案，而只是希望他們寫一封信（文長約一頁左右），表示對本工程有興趣。並索取他們印行的說明書，和要提出一張經他們完工的類似工程的名單，和客戶的地址和字號。

次一步驟便是寫信給該客戶，詢問是否願意推薦該公司承接類似的工作。並且說明如推

work. Ask him also to please be as specific about any reservations which he must place upon his recommendation.

Selecting the Short List

From the information now at hand, one is already able to evaluate the long list of firms to some degree against the selected criteria. Usually, there will be a few firms which stand out as having outstanding qualifications for the particular project. The number of firms on the short list should be three, four or five.

Request for Proposals

Up to this point in the process, the candidate firms have not been requested to do anything other than supply some of their readily available standard literature. One of the reasons for keeping the short list short is that the request for a proposal may put the firms to a considerable amount of expense and it is unfair and unreasonable to have a large number of firms put to this expense. The proposals which are requested at this stage should not include financial terms, but rather should give the names and curriculum vitae of the key professional staff who would be supplied to the project, and discuss briefly the technical approach and methodology which would be employed by the firm.

An interesting approach which is becoming increasingly popular in the calling of proposals for architectural work has been to pay the firms for the preparation of the proposal. This has not been the general practice for engineering proposals but might well be considered as a possibility.

荐有保留的地方，务请具体地说出来保留的各点。

缩编一张短名单

现在手头上有足够的资料了，于是根据评选标准，把上召那一长名单缩编成为一张短的名单。通常总有几个商号，对于本工程来说，资格特别优良，显得格外突出。短名单上的商号大约为3-5个。

邀请提出计划案

到此为止，候选商号，除开供给一些印行的说明书之外，并没有被要求作其他的事。其所以要把短名单编得更短一点，理由之一，便是提出计划案，对某公司来说，花费不小，因此要求许多公司花费这笔钱便显得有欠公允。计划案里不应当列出财务条件，但是应当列出拟派任本工程主要负责人的姓名，和履历表，并且简略地讨论拟采用的技术方法。

在邀请提出计划案时，（特别是建筑工程），目前日渐流行的办法，便是付款给受邀请的公司，请他们提出计划案。

这种办法对于其他工程还不普遍，但也不妨认为将来也有可能性。但是付款办法，使得

The quality of proposals and the willingness of firms to submit them has certainly been greatly improved with regard to architectural work on which this approach has been taken.

Final Selection of Firm

The selection of one firm from a short list, based upon proposals and other information available concerning the firm, is an important process which is frequently carried out by a carefully selected committee experienced and knowledgeable on the subject. Each committee member independently gives a rating to each firm for each of several criteria which have been selected in advance by the committee. Usually, each committee will develop its own list of criteria and they may give different weights to each criterion. Usually, the committee members rate each proposal independently and then the ratings of all the committee members are tabulated and circulated and a discussion is held to seek to resolve any significant differences of opinion which have appeared from the rating forms.

Contract Negotiations

It is in the contract negotiation stage, in discussion with the single selected firm, that financial contract terms are entered into in detail. There is enough precedent and guidelines of various types to follow so that it is usually not too difficult to arrive at a mutually agreeable financial contract. Should negotiations break down with the selected firm, as does sometimes happen, then, since the selection committee will have rated all of the firms on the short list in order of preference, negotiations may be entered into with the second firm on the list.

商宁乐于提出计划案，因之计划的品质也大为提高。

择定一宁厂商

根据计划案和其他已获得的资料，从短名单里凸选定一宁厂商承办本工程。这是一樁极重要的步骤。因此要由一个委员会来决定。该委员会的各成员必须关于本工程具有丰富的学识，和经验。各委员按照委员会所预先拟定的标准，对于各宁厂商详细评定等级。通常每一个委员会拟出来自用的标准并且每一项赋与比分，然后把各委员的评分列成一张表传阅。关于某项目，评分有重大歧异的地方，再开会讨论来决定。

合约议价

约请所选定的厂宁，议定合约财务条件，然后详细写明。关于各样工程有不少先例可寻。因此要达成一件互利的契约，应当不会有太大的困难。万一与该厂商谈判不成功，那么委员会便择定次优的厂商来议价订约。

THE CONTRACTING PROCEDURE AND PAYMENT FOR A CONSULTING ENGINEER

by

Yves Beauregard

- Essential points in contracts (standard contract)
- Scope of assignment, e.g. phases, personnel, charges, time or duration
- Define responsibilities
- Information to be supplied
- Services and facilities provided by client
- Reporting, discussion and review
- Renewal, extension, cancellation
- Copyright, proprietary, trademarks
- Guarantee, penalties, arbitration
- Checklist of contract provisions
- Special agreements
- Cost factors
- Advise of fees and/or charges including methods and level - recommendation
- Payment
- Liabilities
- Protection of the client
- Prepare a checklist

订合同的程序和顾问工程师的付款

包睿戈

摘 要

- 合同中的必需点 (标准合同) .
- 课题的工作范围, 例如: 可分之工段, 多少人员, 需时多少 .
- 职责的定必 .
- 所需之资料 .
- 由顾客供给的服务和设备 .
- 写报告, 讨论和检查 .
- 对合同的重订, 延长, 取销 .
- 复印权, 专利, 商标 .
- 保证, 罚金, 调停 .
- 合同条项的核对表 .
- 特别协议 .
- 费用的各要素 .
- 酬金的商量, 和/或索款的方法及水准—推荐 .
- 付款
- 债务
- 对顾客的保护 .
- 核对表的研制 .

THE CONTRACTING PROCEDURE AND PAYMENT FOR A CONSULTING ENGINEER

The relationship between client and consultant should be clearly stated in writing before the actual work on a project has begun. The written agreement may be in the form of a letter of agreement or a formal contract. Management consultants generally prefer the former. On the other hand, formal contracts are usually used for consulting engineering and construction projects. Whichever form is used, those who negotiate an agreement should bear in mind that the responsibility for interpreting its terms may eventually pass to other persons. It is, therefore, essential that all points should be in writing.

The contract should be as brief as is consistent with absolute clarity. Excessive detail tends to obscure the salient points by dwelling on minutiae which may be confusing or contradictory.

A contract clearly defines an agreement between two or more parties and lists their respective obligations under the agreement. While there is no standard contract format for engineering services which is universally applied or applicable, we can nevertheless establish that a contract between a Canadian consulting engineering firm and a client such as a department or agency of the People's Republic of China would normally include the following main items: the scope of the work and services to be rendered; consultant and client participation and contribution; and the remuneration and methods of payment.

订合同的过程及顾问工程师的报酬

在工程实际开工以前，顾客和顾问中间的关系，一定要清楚的写在纸上，这份写好的协议可以采取文件的形式，或者正式合同的形式。行政顾问们通常喜用前者，而另一方则，正式合同形式却一般用于顾问工程和建筑工程。无论采用那一种形式，那些负责谈判而编写协议的人都应该记住，由于诠释该协议条文的责任，很有可能落在另外一些人身上，所以必需将每一点都记录下来。

合同应该写得简要，前后一致，并且清清楚楚。过分的细节会分散人的注意力，使人忽略重要点，甚至搞乱人的思维或引致矛盾。

一个合同清楚的订出双方，或几方当事人间所协意的事项，和列出该项协意下各方当事人的责任。虽然并不存在一种应用于全世界，或可应用于全世界的工程业务合同的标准形式，我们仍是可以制定，一个加舒大顾问工程公司和一个顾客，譬如中华人民共和国的一个部门或代理处，他们之间的合同，在正常情况下可包括下列几个主要项目：提出工作和服务的范围，顾问及顾客参与和分担的事项，以及报

The terms of reference, the consultant's proposal, the payment schedule and the resolutions to properly and legally authorized the signature of the contractual document, are usually annexed to the contract and form integral parts of the agreement.

The contract format and content can, of course, vary depending on the nature and extent of the engineering services required. However, the basic elements remain relatively unchanging.

Very often it is the consultant who prepares the first draft of the agreement. Since, as a rule, consulting contracts cover highly technical services, it is essential that the section describing the services to be performed, the sequence of work, the information to be supplied by the client and the terms of payment should be prepared by someone with a considerable knowledge of these matters. A comprehensive checklist of provisions to be considered for incorporation in contracts may be found at the end of this section.

Standard printed contract forms have been worked out by a number of government agencies, business firms and professional associations. A model form of contract and some typical examples of general clauses of contracts from international organizations are included in appendices to this paper.

ESSENTIAL POINTS IN CONTRACTS

Scope of the assignment

酬和付款方法。

职权范围，顾问的建议，付款的时间表，以及适当合法的审定合同文件上签名的决心，通常是附加在合同上而成为协意不可缺少的一部份。

当然，合同的形式和内容，可因工程服务的性质和范围的不同要求而有异，但其基本成分却相对的保持不变。

最多的情况是，顾问是协意的最初起草人，因为作为一个原则，顾问承包的事项包含高度的技术服务。而描写该服务的段落是必需被完成的，还有工作的顺序，由顾客供给的各项资料，以及付款的条件等，都应由对这些事项有相当知识的人来订出的。被认为合同中的结合而设的条件综合核对表，可以附在这段的最后。

印好的标准合同表格已由一些政府代理处，商号，和职业团体研制出来。从国际组织得来的一个模型合同表格，和几个合同中一般条款的典型例子，将包含在这篇文章的附录中。

合同中的必需点

工作任务的范围

Successful consultant-client relationships depend on the proper definition of the assignment. The amount of detail necessary for this purpose varies widely. In some cases, such as a continuing advisory service, the description may be quite brief, while in others, such as the specifications for a large installation, lengthy descriptions may be required.

The terms of reference and the consultant's proposal, attached in annex to the contract, specify in greater detail the quantity and quality of the required engineering services.

The services to be rendered will, of course, vary according to the type of project being undertaken. These can be broadly categorized as follows:

- Economic, transportation, regional development, industrial engineering or other pre-feasibility or feasibility studies.
- Preliminary and detailed engineering study and preparation of plans and specifications.
- Supervision of actual construction work.
- Project and construction management
- Airborne and miscellaneous other surveys and exploration, and report.
- Advisory services
- Short assessment study and preparation of terms of reference.
- Turnkey projects, which combine engineering and construction.

成功的顾问—顾客关系，建立于正确的工作任务的定义上，为达此目的所需书写细节的多少，因情况的不同而异。在某些情况下，譬如长期不断的咨询服务，其说明部份可能相当短，而在另外的情形，如详细解说一大型的装置，便可能要求长篇的说明。

在合同附件中的研究范围及顾问的建议，用很多的细节来详细说明分量，和所需工程服务的分量。

进行的服务当然依正在进行的工程的类型而有别，这可以笼统分类如下：

—经济，运输，地域性开发，工业工程，或其他可预行或可行研究。

—初步的和细节的工程研究，以及对方案和说明的准备工作。

—管理实际的建筑工程。

—工程和建筑管理。

—空中和其他多种的测量及勘查，和报告。

—咨询服务。

—短的估值的研 究，及职权的准备工作。

—结合工业和建筑的枢纽企业(TURN-KEY PROJECT)。

Definition of the scope in successive phases

When the contract covers a number of successive phases of a project, the scope, estimated time for completion and fee arrangement for each phase should be outlined in detail. It may not be possible to prepare a contract covering the complete project because the services called for in later phase cannot be foreseen with reasonable accuracy, that is to say, not until the information based on the completion of the earlier stages becomes available. In such cases, the contract may cover only the first phase. If it is expected that the consultant will undertake later stages, it is good practice to describe these stages in the contract in conditional terms without making them binding. It is advisable to give a preliminary estimate of their probable cost and duration, where possible, with suitable wording to show that these estimates will not constitute a firm agreement until the necessary information is available.

Change of scope

Both client and consultant, but particularly the latter, should be alert to any appreciable changes in the character and extent of the work during the course of an assignment. Indeed, these

连续数段的工程工作范围的定义

当合同包括一个方案的数种连续阶段时，那在工作范围中，对完成所需时间的估计，对每一阶段酬金的安排，都应特别详细写出。要制成一个包括全部工程的全同有时是不可能的，因为工程后段所需的服务，往往不能合理准确的事先看到，也即是说，在因前段工程之完成而能收集到的资料未得出以前，不能合理准确的看到。在这种情况下，合同可能仅仅包括前段工程，假如该顾问也要作后段工程的几个阶段，那么在合同中将那几个阶段以有条件的字句描写出来，并不固定它们，是一种好方法，可作一初步的对可能的费用及所需时间的估计。可能的话，并用适当的字句指出，该项估计，在没有得到必要的资料以前，将不作为固定的协议。

工程范围的改变

顾客和顾问，特别是后者，应该警觉于在作业进行中所产生的可以感觉得到的工作的质及范围的改变。这改变可能会达到足够的大小，以致引起原订责任的更迭，而必需作出相应修改合同的准备。顾问方在工作速度及努力程

may be of sufficient magnitude to call for alterations in the obligations assumed and provision should be made for such changes in the contract. Increases or decreases in the rate or amount of effort on the part of the consultant, not provided for in the original agreement, should, as soon as possible, form the subject of an amendment reflecting the change. Otherwise, disagreements might arise after a considerable change in the work pattern has taken place.

Changes of scope resulting from unforeseen economic or technical developments are unavoidable. However, some unnecessary changes may be avoided if the decisions concerning successive phases are taken when each preceding phase has been completed.

Responsibilities of the Consultant

The consultant will be requested to carry out all the work described in the agreement.

There should be a definition of the maximum time allowed for the commencement of work after the approval of the contract. The maximum time allowed for completion of the work is also specified and the schedule for completion of various phases of the work is presented, usually through a bar chart or some such graphical form.

The consultant is asked to give the names of the individuals who are to undertake and assignment and describe their qualifications. However, it is good practice to allow him some freedom in the selection of project personnel. The list of the persons he presents may, therefore, contain alternates. In fact, considerable leeway should be given the consultant in the assignment of personnel as unforeseen circumstances may, in his judgement, necessitate the use of other specialists not included in the list. Such matters should be discussed with

度的增或减，而不是原合同中所规定者，都应该尽快的按照改变而形成一修改合同的课题。不然的话，在当工作的状态产生了可观的改变以后，各方当事人间可能会发生歧见。

由事先无法预料的经济或技术发展所引起的工程范围的改变是无法避免的，但是若能在前一阶段工程完成时，便对连续下去的数段工程作出决定，那么一些不必需的改变是可能避免的。

顾问的职责

顾问要执行协议所载的所有工作。

应该规定在合同订好后，在多少的时间以内一定要开工，也要详细说明在多少时间以内要完成全部工程，甚至也要作出完成不同工段的时间表，通常用线条图或图解的形式。

顾问有义务公开每一个从事工作人员的名字，和呈述他们的才能，但若能给他在选择工作人员方面以一些自由，是有好处的，因此在他提出的人员名单中可能有更换，事实上，在指派人员方面应给他相当的余裕，因事先不可预料的情况可能必需聘用不包括在名单中的专才，这些事应和顾客方面的责任人讨论并征得

the project co-ordinator of the client and his agreement obtained.

The consultant should be available for conference with the client.

Also specified in the contract are the language, number, type and schedule for the submission of reports, drawings, etc.

These may include:

- Short but frequent progress reports listing progress and expenses thus far, preliminary observations, objectives for the next work period, etc.
- Preliminary reports, sketches and specifications for discussion and approval.
- For large multi-phase projects, reports at the end of each phase giving a summary and results of past work and outlining the work recommended to be done in subsequent phases.
- Final reports, drawings and specifications at the end of the project. Reports are normally submitted in an initial draft form for comments and approval, followed by a revised final version.
- Tender documents, terms of reference for further studies, etc.

The amount of authority the consultant is to have vis-a-vis third parties should be stipulated in the contract. The consultant's position in relation to subcontractors, suppliers of equipment and other third parties, as well as in relation to the client's personnel who are to work with him or under his authority, should be carefully defined.

他的同意。

顾问应该出席与顾客的会议。

在合同中并应说明，出报告及图表等应用的语言，出报告次数，形式，以及出报告的时间表，这些可包括：

—短而频繁的进度报告，列出进度和至现阶段的花费，初步的视察报告，下一阶段工作的目标等。

—初步报告，草图，和说明，用于讨论及审定。

—对于大的多段的工程，在每一工段完成时出报告，对刚完成的工段作一总结，并特别指出，那些被建议的工作将^在下几个工段完成。

—全部完工后出总报告。图表及说明，通常先写成草稿给有关方^面批评和审定，再经修订，写出总报告。

—提出文件，为更进一步研究的职权等等。

当有第三方的当事人存在时，顾问对第三方^面的职权应在合同中规定好，在和包括在合同中的其他人，仪器的供给者，另外的第三方，以及在顾问下工作的顾客方^面的人员，在与这些人接触时，顾问的地位都应小心的加以订定。

The consultant may design the plant, choose equipment suppliers and supervise the erection and installation of the plant. On the other hand, the consultant may have to consult his client before issuing certain instructions to third parties or be given complete authority over third parties and be entrusted with the supervision of their work.

Responsibilities of the Client

The responsibilities of the client often include, but are not limited to, the following provisions, at no cost to the consultant.

The client should provide, in a pre-defined format, all the required information necessary to carry out the project, as described in the terms of reference and the proposal. In the case of excessive delay in supplying required data, provision should be made for the collection of information by the consultant at the expense of the client. The client is also responsible for the accuracy and interpretation of the information supplied to the consultant.

It is most important that the client should instruct his staff to supply the consultant with all relevant information freely and not necessarily wait until it is asked for. The nature of the information and the manner in which it is to be disposed of should be stipulated in the contract after it has served its purpose. Ethical behaviour requires that such information be held in confidence by the consultant unless otherwise agreed.

The client is required to obtain the necessary visas, licences,

顾问可能设计了工厂，选择仪器供给者，并监督建立和安装工厂。但另一方面，顾问可能必须先与顾客磋商，才能对第三方发出某些指令，或被授予管理第三方的全权，以及被委托督导他们的工作。

顾客的职责

顾客的职责通常包括下列几条，但并不限于这几条，并且不可要顾问付出任何代价。

顾客应该供给用预先订好的形式搜集的一切有关进行该项工程的必需资料，正如职权和建议中描述的那样，在过份拖延供给该资料的情况下，顾问应着手准备搜集该项资料，而顾客需偿付一切花费。顾客也必需对资料的准确性及资料的翻译负责。

非常重要的一点是，顾客应指令他的工作人员们自动的供给顾问以一切相干的资料，而不必等到问他。当资料被应用过了以后，资料的性质和其被处理的方式都应在合同中加以规定。除非有特别的协议，否则顾问在道德的规范下，应对该等资料保密。

顾客需负责使获得一切为使工程得以进行所需之各种签证，执照，通行证，许可证等。

passes, authorizations, etc., for the carrying out of the project and to facilitate the customs and immigration procedures for all personnel and equipment. The expatriate personnel should be free from all local income taxes and duties and the consultant should be free from all local corporate and other taxes; otherwise, these taxes would have to be added to the consultant's expenses charged to the client.

The client should assist in the securing of communications facilities, logistic support, transportation and lodgings, and should provide office space and furniture, secretarial personnel, translators and interpreters and office supplies such as paper, photographic reproduction equipment, etc.

One of the most important contributions of the client is the provision of qualified local counterpart personnel to work closely with the consultant's expert staff. This is to the mutual advantage of both client and consultant. On the one hand, it aids the consultant in the performance of his duties by supplying local expertise, thus assuring quick completion of the project and avoiding the need for additional consultant's staff. On the other hand, it allows a core of local personnel to familiarize themselves with other techniques and procedures and permits a better liaison between client and consultant.

Co-ordination and Steering Committee

It is advisable to designate two persons, one from the client and one from the consulting organization, to be directly responsible for policy decisions regarding the fulfilment of the contract provisions. Preferably, they should have been present at the discussions leading to the contract. Thus,

并促使所有工作人员及装备在海关及移民局所要办的各种手续变易,国外来的工作人员应免纳一切地方所得税和其他税。顾问应免纳一切地方团及其他税务。不然这些税便该加在顾问的开销中而由顾客支付。

顾客应协助使获得通讯装置,逻辑的支援,运输,和住房,并应供给办公场所和伙伴,秘书人员,译员及口译员,以及办公室用品如纸张,照像复制装备等。

顾客最大的贡献之一是,准备一些当地有才能的相应人员,去与顾问的专家们紧密工作在一起,这对顾客和顾问双方都有利。一方面,顾问在执行其职责时可得当地专家的帮助,因而保证了快速完工和避免顾问需增加他的人员。另一方面,一些当地人员可以因而熟悉了其他的技术和工作程序,因而使顾客与顾问间产生更好的联系。

协作和指导委员会

一个很值得采取的办法是,从顾客和顾问两方各任命一负责人,直接对履行合同中各条文而作的各种决策负责。最好这两人都曾参与订合同的全过程,因而对协议的背景全部了然。

they will be fully informed of the background of the agreement.

The client project co-ordinator also acts as liaison between consultant and client, aids in the obtainment of required information, visas, etc., and assists the consultant in all relations with local agencies, businesses and associations.

The client should also establish a steering committee which will have full authority over all aspects of the work. The Committee should be chaired by the client's co-ordinator and composed of representatives of all the client departments which are implicated in the project. The consultant representatives will be de facto members of the committee, and the consultant's co-ordinator will act as secretary.

The committee should meet on a regular basis and would be responsible for the approval of interim and final reports submitted by the consultant and for the orientation of the entire project.

Constant exchange of ideas is important to maintain confidence and remove causes for misunderstanding before they have time to develop. In spite of the schedule, however, a representative should never be too busy to meet the other representatives to discuss an urgent matter.

Financial Arrangements

The type of fee, the length of time during which it is to apply and the method of payment should be stated for each successive stage of a project. Because of the importance of this subject, I will discuss it at length at the end of this paper. But, it is important to stress right now that the contract state the

顾客方凸的负责人，又可作为顾问和顾客间的桥梁，协助顾问获得所需的资料，签证等，并在顾问与当地代理处，商店，社团交往时给予帮助。

顾客也应设立一指导委员会，对工作的各方凸有全权。这委员会应以前述负责人为主席，成员则为顾客方凸与该工程有关连各部门的代表。顾问方凸的代表们将成为委员会的

成员，而顾问方凸的负责人则担当秘书的身份。

委员会应定期聚会，对顾问的分段及总结报告之审定负责，并对全部工程的方针负责。

为保持彼此的信任，为互误解的根源没产生以前就消除它，经常交换意见是很重要的。不过，不管时间表是怎样的，不管是如何的忙碌，一个代表总应该可以抽出时间来与其他代表们讨论紧急事务。

财政的安排：

酬金的类型，和有效的时期，以及付款的方法，都应事先为工程连续的每一阶段订好。因为这一主题是如此重要，我将在这篇文章的结尾处用较多的篇幅来加以讨论。但是，现在仍

currency or currencies in which payment is to be made and the basis for currency conversion. If there are regulations limiting the transfer of money abroad, it is advisable to stipulate in the contract the obligation of both consultant and client to comply with these regulations. Many contracts contain a provision for the payment of interest on delayed payments. The tax liability of the consultant should likewise be stipulated.

Term or Duration

All consulting contracts should include a statement of the time during which they are to remain in effect. Provision must be made for modifying the original term including the time limits within which requests for modification must be made by either party.

Renewal or Extension

The method to be used for mutual agreement to extend or renew the contract may be specified in the provisions. The fee arrangements in cases of extension or renewal should also be stipulated.

Cancellation During Course of the Project

Contracts should specify the conditions under which either party may terminate the agreement including the amount of advance notice required, provisions for suitable completion of the work in progress and the settlement of costs incurred by the consultant up to the time of the cessation of the work.

必需強調指出，合同应订好付款将用何种或那些货币，以及货币兑换的基础。若是存在对金钱汇出国外的限额的管制，一个好办法是，在合同中规定好顾问及顾客两者都有遵守该项管制的义务。很多合同且含有关于迟付款时要付利息的条文。而顾问的纳税义务也应同样的加以规定。

期限或期间：

所有的顾问合同都需注明该合同的有效期限，也必需有必要时可以修改原期限的条文，并订出一时间限制，超出该时限后，任何一方皆不能要求修改期限。

重订或延期

在双方同意下，延长或重新订合同的方法可在条文中写明，在延长或重订合同的情况下，费用的安排也应该规定好。

在工程的进行中取消合同：

合同应写明在何种条件下任何一方可以终止该协议，包括最少在多少时间以前要通知对方。适当完成正在进行中的工作的条文，以及直至停工时为止顾问费用的结算。

文件的所有权：

Ownership of Documents

For international projects, it is often specified in the contract that all maps, graphs, plans, statistics, etc., collected for the project, are the property of the client. The consultant is authorized to retain copies of these documents but may not use them for any purpose other than for the execution of the contract without the prior approval of the client.

On the other hand, all original designs, drawings, computer models, etc., prepared by the consultant, represent the product of training, experience and professional skill and normally are considered to belong to and remain the property of the consultant, unless otherwise provided for in the contract.

Licensing of Proprietary Information

In considering the introduction of new products or processes into a country under the present system of patent protection, one must bear in mind that the inventions may not be covered by patents valid in that particular country. Hence, the transfer of information and know-how comes under the general category of the licensing of proprietary information.

The major reason for obtaining such information is to save time. In a particular country, the need to install a new process or product as rapidly as possible may make it necessary to obtain the required information from a foreign source. Sometimes such information may be provided by an engineering firm as an important part of the service he has to offer. When an outside engineering firm is engaged to plan and construct a facility,

对国际间的工程而言，通常都在合同中注明，那些为工程而搜集的地图，图形，计划，统计表等，全属顾客，顾问有权保留这些文件的副本，但除非事先得到顾客的批准，他不能应用该等文件于执行该合同以外的任何事。

在另一方面，所有新的设计，图样，计算机模型等，由经过训练，有经验，有专业技工了的人制成的。由顾问所准备的文件，一般被认为是顾问的财产，除非在合同中另有规定。获取运用专利资料的许可：

当要将一种新产品或新方法介绍到一个国家中去时，在目前存在的保护专利的体系下，我们必需记住，那些发明可能不包含在该国有效的各种专利中。因此资料的转移及知道如何去做，便是包括在“获取运用专利资料的许可”的项目下。

要去获得该等资料的主要原因是为节省时间。在某一个特别国家中，由于需要尽快安装一种新的制法或生产，可能必需从外国去获取所需资料。有时此等资料可由一工程商号供给，这是此等商号所供服务的一个重要部份。当一另外的工程商号被约定来设计和建筑一项设备

it will normally have to provide process and product information as part of its assignment.

Legal Jurisdiction

If the client and the consultant are in areas in which different legal systems are in effect, the jurisdiction under which the terms of the contracts are to be construed should be specified. If the contract is drawn up in more than one language, it is good practice to state which language is the "ruling language" for purposes of the interpretation of the contract.

Guarantee of Performance

Contracts sometimes provide that the consultant must offer a guarantee to ensure that the assignment is completed in accordance with the initial definition. Such assurances are frequently provided by the execution of a performance bond through a mutually acceptable financial institution. These guarantees or bonds are usually not required in connection with contracts for professional services such as studies or advisory services.

In cases such as preparation of plans and specifications, supervision of construction work, project and construction management, airborne surveys, and turnkey projects, a performance guarantee may be required. In such cases an agreed statement of what constitutes successful completion should be included in the contract. The guarantee usually amounts to a small percentage of the professional fees, though, in actual practice, reputable consultants usually exceed the required guarantee to fulfil their professional obligations and to safeguard their reputation through error and omissions insurance policies, when available.

时，正常情况下他也必需供给制法及生产的资料，作为他的课题的一部份。

正当的司法权：

若顾客和顾问所在地存在着不同的法律系统，在该司法权下合同将作何解释应详细说明，若合同是用一种以上的语言写成，最好定出那一种是主要语言，而在口译时运用。

完工的保证：

顾问有时需在合同中提出保证，保证他要按照原先的定义完成作业。此种保证，常常经由一双方认可的财政机构来执行完成的保证书提供的。这类保证或保证书，在职业服务或咨询服务之类的合同中往往是不要求的。

在下列的情形，如计划或说明的准备，监督建筑工程，工程或建筑管理，空运的视查，和枢纽工程（“TURN-KEY”），一个完工的保证便可能被要求。在这些情况下，什么构成胜利完工应经过协议而记载于合同中，虽然这种保证一般只用相当于职业酬金的一小部份，事实上，有声誉的顾问经常超过保证所要求的去完成他们职业上的义务。并通过可能有的保险政策的错误和遗漏去保障他们的信誉。

Guarantee of Payment

Similarly, the client may be requested to guarantee the availability of funds for the payment of the consultants' charges by means of a letter of credit or an escrow agreement or through an international financial institution such as the UNDP, WHO, FAO, CIDA. In the case of Canadian consultants, when the payments are not guaranteed they can insure their contract with Canadian Export Development Corporation but this method is more expensive for the client since he will have to reimburse the insurance premium.

Penalties

In exceptional circumstances, a contract may contain a clause penalizing the consultant for delay or deficiency in performance.

Arbitration

Formal provisions for handling disagreements between client and consultant by means of recognized arbitration procedures should be included in all agreements.

Special Provisions for Combined Engineering and Construction Projects

Provisions which are ordinarily not opposite to consultative contracts may be included in contracts for turnkey projects. Under this system, the same organization not only provides engineering services but also undertakes construction. In such cases, as indicated previously, it is appropriate to require performance guarantees since the consultant is acting as a

付款保证：

同样的，顾客可能被要求以一封任用文件，或特别协议，或通过国际间的财政机构，如 U.N.D.P., WHO., F.A.O., CIDA, 提出有足够的基金支付顾问的保证。若顾问是加舒大人，当付款没有被保证时，他们可将合同去加舒大出口发展公司加以保险。但这种方法对顾客来说是更贵的，因为他必需补偿保险费用。

罚款：

在特别情况下，合同可能含有，当顾问迟完工或不足够好的执行工作时，要课以罚金的条文。

调停：

在所有协议中均应包括正式条文，写明当顾客及顾问发生歧见时，如何由双方都认可的调停程序处理之。

对综合工程及建筑的工程的特殊条文：

某些原本对顾问性的合同不合适的条文，却可以包括在枢纽工程 (TURN-KEY PROJECT) 中，在这种体系中，同一机构不仅提供工程服务，也同时从事建筑。正如前已指出的，在这种情形下，要求其给予完工的保证是适当的，因

contractor and the performance can be determined.

In some cases, the contractor is asked to assume responsibility for the regular operation of the facility at a guaranteed rate of performance. In order to do this, he must have full control over supervisory and operating personnel, raw materials, utilities and specifications for finished products adequate for the performance under the terms of the guarantee. If he is not given full control over these, the possibility of performance at design capacity is a hazardous commitment on his part. Furthermore, the contract may provide that a bonus will be paid to an engineer-contractor for the completion of the project ahead of schedule, while a penalty may be assessed for delay in completion beyond the date specified in the agreement.

CHECKLIST OF CONTRACT PROVISIONS

It is usual for a client to have a checklist to review contractual documents submitted to them. The following is an example of such a list and serves as a summary of what I have discussed thus far. It is a general list and all provisions may not apply in many cases.

Introductory Clauses:

- (a) Date of agreement
- (b) Identification of client and consultant, including transfer of responsibility to successors. If the client is a public body, the authority under which it acts and the source of available funds should be specified.

为顾问是承色人，因而对工作的履行作出决定。

在某些情况下，承色人会被要求，对设备按保证的工作速度正常的操作负责。为达此目的，他必需对所有督导及工作人员，原料，有用物等有绝对控制权。并对适合于所提保证而完成之产品之说明有绝对控制权。假如他未被给予此等绝对控制权，那么他对工程将按设计的素质完成的可能性的承诺，是很有风险的承诺。尤有甚者，在合同中可能规定对提早完成任务的工程师，承色人发于奖金，而对过期尚未完工的课以罚款。

合同条文核对表

顾客通常拥有份核对表，用以检查交给他们的有关合同的文件。下页有作为例子这样一份表，并作为我前页所讨论事项的总结。这是一份一般性的表，若干条文可能不能应用于某些情况。

绪言条款：

(a) 订协议的日期。

(b) 顾客及顾问的身份，包括将责任交给继任人。若顾客是一公字机构，这机构的上级和资金的来源应加详细说明。

- (c) Review of the background and brief definition of the project.
- (d) Scope of the assignment, including reference to any detailed description incorporated in appendices.
- (e) Effective date of commencement of work, when different from (a), and estimated or stipulated time for completion.
- (f) Designation of individuals in client and consultant organizations responsible for policy decisions.

Responsibilities of the Consultant:

- (g) Professional help, services and information to be supplied.
- (h) Work schedule to be maintained.
- (i) Personnel to be supplied (may be detailed in appendix).
- (j) Availability for conference with the client.
- (k) Reporting, including the schedule, nature and language of reports.
- (l) Ownership of designs, blueprints, reports, etc., to be specified in the contract.
- (m) Safeguarding of information supplied by client
- (n) Guarantee of performance, where required.

Responsibilities of the Client:

- (o) Information, services and facilities to be provided.
- (p) Availability for conference with the consultant, co-ordinator, steering committee.

(c)检查工程的背景及其简单定义。

(d)工程范围，包括任何编入附录中的，作为参攷的细节描写。

(e)开工日期，若与(a)不同的话，并估设或规定完工日期。

(f)在顾客和顾问的机构中，任命对决定工作方针负责的人选。

顾问的职责

(g)供给专业帮助，服务及资料。

(h)遵守工作时间表。

(i)供给工作人员。（也许在附录中加细节说明）。

(j)参加与顾客的会议。

(k)作报告，包括写报告的时间表，报告的性质及所用的语言。

(l)在合同中说明，设计，蓝图，报告等的所有权。

(m)安全保存顾客所供给的资料。

(n)凡被要求时，作完工的保证。

顾客的职责

(o)供给资料，服务，和设备。

(p)参加与顾问的会议，以及协作督导委员会。

Duration of Contract:

- (q) Stipulation of termination, either by stating a specific date or by indicating the duration of the operation from the execution of the contract.
- (r) Provision and mechanism for the modification of the specified date by mutual agreement.
- (s) Provision for extension or renewal.
- (t) Provision and mechanism for early termination by either party.
- (u) Termination by reason of events beyond control of either party.
- (v) Provision against delays.

Financial Provisions:

- (w) Total financial commitment by the client.
- (x) Method and schedule of billing by the consultant.
- (y) Method of payment
- (z) Currency or currencies of payment and conversion rates.
- (aa) Guarantee of payment by the client.
- (bb) Payment of interest on delayed payments.

General Provisions:

- (cc) Legal jurisdiction for the interpretation of the contract.
- (dd) Insurance provisions.
- (ee) Best efforts pledged by both consultant and client.
- (ff) Handling of disagreement through arbitration procedures.
- (gg) Obligations for visas, permits, licence fees and taxes.

合同的有效期限：

(Q)规定工程结束时限，写出一特别日期，或者履行合同上注明之工作期限。

(R)经双方同意而修改日期的条文和技术。

(S)延长或重新订合同的条文。

(T)任何一方要提早结束的条文和技术。

(U)因不能由任一方控制的事件之原因，而导致的结束。

(V)于迟完工不利的条文。

财政条文：

(W)顾客承担所有的财政义务。

(X)顾问付账的方法和时间表。

(Y)付款的方法。

(Z)付款所用之货币，以及兑换率。

(aa)顾问付款保证。

(bb)迟付款时之利息。

一般条文：

(cc)翻译合同的适当司法权。

(dd)保险条文。

(ee)顾问和顾客两方作最佳努力的保证。

(ff)经过调停处理歧见。

(gg)各种签证，许可，执照费和纳税的义务。

CONSULTING FEES AND METHODS OF PAYMENTS

A number of different systems have been developed for the remuneration of consultants. The system selected for a specific project or stage of a project will depend on preferences and the type of project.

It is important that the arrangements regarding the fees to be paid should be carefully stated in the contract. The method of calculating fees, the frequency and method of payment, the currency of payment (including the basis of currency conversion) and the time period covered should be outlined in detail. If different compensation methods are used for individual stages of a project, it is important to keep the above points in mind for each stage.

Cost Factors

There are many methods of calculating and quoting fees. All systems have in common the consultant's desire to cover the costs of carrying out a project and to make a profit. The principal cost factors of an assignment include: (a) salary costs; (b) direct out-of-pocket expenses; (c) overhead expenses related to the project; and (d) other costs.

(a) The salary costs of the consultant include:

- Salaries for all time spent directly on a project by principals and staff;
- Applicable sick leave, vacation and holiday pay;

顾问费和付款方法

关于顾问的报酬已经发展成几种不同的体系，对一特别的工程或工程的某一阶段，要选那一体系，将依参加资料及工程的种类而定。

重要的是，关于要付的费用的安排，都应小心的列于合同中。计算费用的方法，付款的次数和方法，付款的货币（包括兑换货币的基础），以及有效时期都应一一详细列出。假如在每一工段使用不同的偿付方法，那么在每一工段均记住以上数点是重要的。

费用的各要素：

有很多种计算酬金，及应要多少酬金的方法。所有体系都有一共同点。即是：顾问的酬金不单要能支付一切费用，还要有利润。一项工程的主要费用要素有：(a)工资，(b)接直花费（OUT-OF-POCKET EXPENSES），(c)工程的经常费和(d)其他费用。

(a)顾问的工资支出部份包括：

——把全部时间直接花在工程上的负责人和员工的工资。

——合于条例的因病缺工，假期，和放假之工资。

- Employer contributions to medical and life insurance benefits, retirement benefits, unemployment insurance and other social benefits. According to the country and the individual organization, these may range from 15 to 50 per cent of the basic salary;
- In the case of foreign consulting assignments, special overseas allowances and family separation allowances may also be paid to the consultant. These additional inducements vary considerably with the length of the assignment and the conditions prevailing in the country of assignment. They may range from 20 to 60 per cent of the base salary.

To determine the salary cost of consultant per each effective working day, it is first of all necessary to calculate the number of actual working days in a year. This is done by subtracting from the total number of days in a year weekends, public holidays, vacation days and an average number of days for sick leave. Depending on the country, there are approximately 220 effective working days per year, which is equivalent to 1,760 man hours (eight hours per day).

The following calculation of the salary cost of a consultant on foreign assignment per effective working day is given for purposes of illustration. The same principal would apply for the calculation of salary costs per hour or per month. The base salary (given in Canadian dollars) and percentages are arbitrary and should not be interpreted as guidelines. It should also be pointed out that this method of calculation is highly simplified.

——雇主捐助的福利：医药和生命保险，退休金，失业保险，和其他社会福利。按国家和个别组织的不同，这可能有价值基本工资的百分之15到50的差异。

——在去外国从事顾问工作的情形，顾问也可能领到海外津贴和家庭分居两地的津贴。这种额外的好处，会因工作时间的久暂，以及在该国一般流行的条件，而有很大的差别。这差别可以值基本工资的百分之20到60。

要决定一个顾问每一有效工作日的工资，最先必需要算出每年有多少有效工作日。算法是：从一年的总天数中减去週末，公共假日，假期，和平均病假日，按国别而不同。但一般大概每年有220有效工作日，也即是1,760工作时（8小时一天算）。

以下所述的，一个在外国从事工作的顾问，其每一有效工作日工资的计算，是为了作一具体说明而设的。因这样的原则可用于计算每小时或每月的工资。其基本工资（以加舒大元给付）以及各种百分率是任意写的，不能将其翻译而作为准则。也应指出，这计算法是被高度简化了的。

$$\begin{aligned} & \frac{\$ 22,000 \text{ (annual salary)}}{220} + \\ & \frac{\$ 22,000 \times 15\% \text{ (estimate of special overseas benefits)}}{220} + \\ & \frac{\$ 22,000 \times 25\% \text{ (estimate of special overseas allowances)}}{220} - \\ & \frac{\$ 22,000 + \$ 3,300 + \$ 5,500}{220} = \frac{\$ 30,500}{220} = \$ 140.00 \text{ (salary cost per} \\ & \hspace{15em} \text{effective working day)} \end{aligned}$$

The above costs do not take into account profit or overhead costs which are outlined below. The salary cost of a consulting assignment is based on the number of man hours or days or months worked by each professional and technical employee, multiplied by the respective rate per effective working day or hour or month for each.

(b) Direct out-of-pocket expenses incurred for a project include:

- International travel to and from the project for personnel and, for long-term assignments, for families or personnel;
- Costs of transporting personal effects;
- Living expenses of consultants and, in some cases, of their families;

$$\begin{aligned}
& \frac{22,000 \text{ 加元 (年薪)}}{220} \\
& + \frac{22,000 \times 15\% \text{ 加元 (对各种福利的大约估计)}}{220} \\
& + \frac{22,000 \times 25\% \text{ 加元 (对特别海外津贴的估计)}}{220} \\
& = \frac{(22,000 + 3,300 + 5,500) \text{ 加元}}{220} = \frac{30,800 \text{ 加元}}{220}
\end{aligned}$$

$= 140.00 \text{ 加元 (每一有效工作日的工资)}.$

以上所述费用，並未考虑下页将列出的福利或海外津贴。一件顾问工作的工资费用，是基于每一个专业和技术雇员所工作的时数或日数或月数，乘以各别的日薪，时薪或月薪而得出的。

(b) 因工程而作的直接花费包括：

——全体人员去到工地和从工地回来的旅费，若为长期工程，则尚有全体人员家属的来回旅费。

——私人财产的运输费。

——顾问们的生活费，在有的情形，包括家属的生活费。

- Local travel connected with the project;
- Depreciation costs or rental of equipment and vehicles;
- Local office space, furniture and supplies
- Costs of special insurances for the project;
- Communication expenses, including long-distance telephone, telegraph, telex, express charges and postage;
- Computer costs and costs of reproduction such as photostating, printing, mimeographing, blueprinting, etc;
- Costs of other local services, including local office staff and other local personnel;
- Costs of sub-contracts, such as laboratory services, field surveys, etc.

The consultant may, if the contract so stipulates, be responsible for all or some of the out-of-pocket expenses. These costs are generally included in the consultant's estimate of fees.

- (c) There are a number of methods of computing overhead costs and what they cover exactly. Overhead expenses vary according to the size and complexity of an organization and range from 80 to 100 per cent or even more of the cost of professional salaries.

Head office overhead expenses include:

- Provisions for head office, light, heat and similar items for working space, depreciation allowances or rental for

- 因公的短程旅费。
- 折价费，或仪器，车辆的租金。
- 当地的办公场所，作俱，和补给品。
- 为工程而作的特别保险费。
- 通信费用，包括长程电话，电报，TELEX，快递费，及邮费。
- 计算机费，复制费如：影印，印刷，油印，蓝印等等。
- 其他地方服务费用，包括由当地聘的办公室职员，和其他当地的人员。
- 附属的合同，如实验室服务，田野测量等。

若合同中有规定的话，顾问可能对全部或部份直接花费负责。这些费用一般是包括在顾问所估计的酬金中的。

(c)已存在几种计算经常费的方法，以及它究竟确实包含些什么，经常费依机构的大小和复杂性而改变，通常相当于职业工资的百分之80到180，甚至还要多。

总办公室的经常费包括：

- 总办公室的各项设备，电灯，暖气，工作场所的相似设备，折旧津贴或作俱租金，

furniture, draughting equipment and engineering instruments, transportation expenses and office supplies not identifiable to specific projects;

- Executive, administrative, accounting, legal, stenographic and clerical salaries and expenses, other than identifiable salary costs and out-of-pocket expenses mentioned previously;
 - Business promotion, such as preparation of technical papers, brochures and proposals;
 - Taxes and insurance other than those included as salary cost;
 - Loss of productive time of technical employees between assignments, training programs, research, attendance at professional meetings and library and periodical expenses.
- (d) Other costs which may be encountered include financing charges, money exchange expenses and cost increases due to escalation. Pertinent clauses must be included in the contract to take care of these items.

Types of Compensation

The types of compensation vary according to preference and to the type of project or services to be rendered. The most usual methods of remuneration can be identified as follows:

- C1- Per diem, plus out-of-pocket expenses.
- C2- Salary cost multiplied by a factor, plus out-of-pocket expenses.
- C3- Salary cost multiplied by an overhead factor, plus fee, plus out-of-pocket expenses.

通风设备及工程仪器，运输费，一般办公用品（无法一项项列出者）。

——行政的，管理的，会计，法律，速记，及书记的工资及费用，而与前述工费用及直接花费有所不同者。

——业务上的进一步工作，如技术论文，小册子，和建设的研写。

——纳税和保险，而不能视为工资用费者。

——技术雇员在一件和另一件工作之间所损失的时间，参加专业训练班，作研究工作，参加专业会议，去图书馆，及其他继续续的花费。

(d)其他费用，如财政捐税，兑换钱的费用，由涨费而引致开销增加，在合同中应有适当的句子提到这些项目。

偿付的类型：

偿付的类型因偏爱，工程的类型，或所提供的服务而不同。最通常的酬报法可分列如下：

C1——论工件计酬加上直接花费。

C2——工资乘以一个因子，加上直接花费。

C3——工资乘以一个经常费因子，加上酬金，加上直接花费。

- C4- Unit or global lump sum.
- C5- Unit or global lump sum, plus out-of-pocket expenses.
- C6- Services at percentage of cost of construction project, plus out-of-pocket expenses.
- C7- Combination of these methods.

We have already mentioned that the types of project can be broadly categorized as follows:

- P1- Economic, transportation, regional development, industrial engineering or other pre-feasibility or feasibility studies.
- P2- Preliminary and detailed engineering study and preparation of plans and specifications.
- P3- Supervision of actual construction work.
- P4- Project and construction management
- P5- Airborne and miscellaneous other surveys and exploration, and report.
- P6- Advisory services.
- P7- Short assessment study and preparation of terms of reference.
- P8- Turnkey projects, which combine engineering and construction.

The types of compensation applicable to the various types of projects can be summarized as indicated in the table below.

C4—单位或全部总计金额。

C5—单位或全部总计金额，加上直接花费。

C6—服务佔建筑工程的估计或实际用费的百分比，加上直接花费。

C7—这些方法的综合应用。

我们已经提起过，工程的类型可以大概的分类如下：

P1—经济，运输，地域性开发，工业工程，或其他可预行和可行研究。

P2—初步的和细节的工程研究，以及对方案和说明的准备工作。

P3—管理实际的建筑工程。

P4—工程和建筑管理。

P5—空中和其他多种的测量及勘查和报告。

P6—谘询服务。

P7—短的估值研究，及职权的准备工作。

P8—结合工业和建筑的枢纽工程(TURN-KEY PROJECT)。

对不同类型工程的不同类型偿付，可总结如下表：

酬金类型	工 程 类 型							
	P1	P2	P3	P4	P5	P6	P7	P8
C1	X	X	X		X	X	X	

TYPE OF FEES	TYPE OF PROJECT							
	P1	P2	P3	P4	P5	P6	P7	P8
C1	x	x	x		x	x	x	
C2	x	x	x		x	x	x	
C3	x	x	x	x				x
C4					x		x	x
C5					x		x	x
C6		x	x					

In general, per diem and lump sum fees are for short-term missions of experts and the other types of fees are for intermediate to long-term projects.

I would like now to give some details on these different methods of compensation.

C1 Per diem plus out-of-pocket expenses

The system of per diem payments is generally used for short-term assignments involving the personal services of one or several consultants. It is particularly suited to assignments requiring the advice of the consultant, the preparation of reports and investigations and activities for which little or no design, drafting or related services are required.

This system of remuneration is commonly adopted by management consultants, economists and specialized consultants. Consulting engineers frequently charge per diem rates for preliminary investigations and reports.

When such services are performed, each professional man is compensated for all the time he has devoted to the job, including travel time, which is prorated on a daily basis. In the case of consultants engaged for the execution of

C2	X X X	X X X
C3	X X X X	X
C4		X X X
C5		X X X
C6	X X	

一般说来，专作短期的任务以论工件计酬和总计金额计酬，而另外型的酬金则用于中及长期的工程。

我现在要给这些不同的偿付法一些细节的描述。

C1 论工件加直接花费：

论工件计酬的体系通常应用于短期工作，而由一个或数个顾问所作的私人服务，这特别适合于只要求下列数点的工作：顾问的意见，报告的编写，需要很少或不需要设计，草案，或相关服务的研究和活动。

这种报酬体系通常被行政顾问，经济学家和特别顾问所采用。顾问工程师们常以论工件的方法对初步研究和报告计酬。

当履行此种服务时，每一专业人员要为工作花的所有时间得到偿付，包括旅行时间，那是以天计的。若顾问为从事一连串相当时间的

projects which require continuous service for a certain period of time, the rates may be established on a weekly, monthly or annual basis. These rates vary with the seniority status, reputation and experience of each person employed. The daily rate may range from CAN \$ 100 for technicians to \$ 400 for senior experts.

As a rule, the per diem fee covers salary and overhead costs as well as profit. In general, out-of-pocket expenses are reimbursable.

When the scope of the project can be defined accurately, the contract may specify the number of working days it will take to complete the project, how many consultants are to be assigned and what the per diem rates will be. This is equivalent to a lump sum quotation. The per diem arrangement, however, provides for adjustments in payment if the work program is altered or extended.

If the scope of a project cannot be defined accurately, the consultant sometimes estimates total fees and gives a bracket quotation. This means that he quotes a minimum and a maximum amount, on the understanding that the work - which will be billed on a per diem basis - will be accomplished within that range unless there is a change in the scope of the project or unforeseen circumstances arise.

C2 Salary cost multiplied by a factor, plus out-of-pocket expenses

The system of salary cost multiplied by a factor and related systems of remuneration, which are based on costs to the

工程，那他的酬金可以週，月，或年来计之。酬金的多少按每人职位的高低，声名及经验而定。週薪可从技工的100加元到高级专家的400加元。

作为一个原则，论工件酬金包括工资，经常费，及利润。通常直接花费是可补偿的。

当工程范围可以准确的给以定义时，合同可对完工所需的工作日数，要请几个顾问，以及论工件计酬的酬金额加以说明。这相当一总金额的报价单。但是，当工作的进度有了改变或延长时，论工件计酬的安排可提供付款的调整。

当工程范围不能准确订定时，顾问有时对全部费用加以估计，并作一附括号的报价表，那即是说，他报一最低和最高额，而以论工件计酬那项工作的花费，将在两额之间，除非工程的范围有所改变，或发生了事先未料到的情况。这也许是初步的工程研究，方法研究或调查，细节工程，建筑管理等等。很少顾问商号用这种方法向顾客索酬。

C_2 依工程所花时间为基础的酬金，是以固定工资单口的金额乘上一个因子来设算的。这因

consultant, is applied frequently in cases when the scope of the work and the professional services required are more extensive. These may be preliminary engineering studies, process studies or investigations, detailed engineering, construction supervision, etc. Many consulting firms have adopted this method of charging clients.

Fees are calculated by multiplying the fixed payroll costs - based on actual time spent on the project - by a given factor. The factor is meant to compensate the consultant for overheads, provide a reasonable margin for contingencies and cover interest on invested capital, readiness to serve and profit. The multiplier varies with the type and size of the consulting organization, as well as with the length and type of assignment, and is usually over 2.0.

Under this payment system, the client may require that proposals be accompanied by estimates of direct salary costs and out-of-pocket costs, broken down into local and foreign currency costs. Normally, the monthly rates will vary from CAN \$2,000 for a technical to \$6,000 for a senior expert. We estimate that out-of-pocket expenses will reach about 30 per cent of total costs.

C3 Salary cost multiplied by an overhead factor, plus fee, plus out-of-pocket expenses

This method of payment, a variant on the previous one, is used for the same types of projects and, in addition, more specifically for project and construction management.

The cost-plus-fixed-fee contract specifies that the consultant shall be reimbursed for the direct costs of all his services and supplies, including salary cost, overhead and out-of-pocket expenses. In addition, the consultant and the client negotiate a fixed fee to cover contingencies,

子用以补偿顾问的经常费，给可能发生的事故一合理的余地，弥补投资款项的利息，乐意去服务和利润。这乘上去的因子依顾问机构的类型和大小而不同，并依工作的长短和类型而有别，一般均超过2.0。

在此种付款的体系下，顾客可能要求，将直接工资和直接花费的估计额，分列成当地和外国货币，与提议一起提出。正常情况下，月薪额将有由技工的2000加元到高级专家的6000加元。我们估计直接花费约为全部费用的30%。

C3工资乘以一个经常费因子，加上酬金，加上直接花费：

这种付款法，是上述方法的一种演变，是用于同类型的工程。此外，更多用于工程和建筑管理。

那种“费用+固定酬金”的合同说明，顾问将得到他全部服务及供给物资的直接花费的补偿，包括工资，经常费和直接花费。除此之外，顾问和顾客协议一对偶然事故的费用，投资款项的利息，乐意服务和利润。对工业工程而言，酬金通常是估计的建筑费用的一部份。

因酬金是固定的，因此合同中应注明，当工程的范围，完工所需时间，或所需要的服务

interest on invested capital, readiness to serve and profit. For engineering projects, the fee is often a percentage of the estimated construction costs.

Since the fee is fixed, the contract should provide for adjusting it at any time when the scope of the project, the time necessary for completion or the services required change substantially.

In project and construction management services, an incentive may be built into the fee which will be tied to an upset price for the completion of the project. If the total cost is below the upset price, the fee is increased proportionately and is decreased proportionately in the case of a cost overrun.

This fee for construction management varies with the size of the project, and ranges from 3 per cent for small projects to 1 per cent for very large projects.

C4 Global or unit lump sum

Under the system of global fixed lump sum payment, the consultant determines a fixed amount of remuneration before starting a project. Consultants generally calculate the charges by means of one of the other systems of remuneration. A substantial contingency provision, however, is usually added to cover business risks.

The scope of the project should be defined precisely and the time within which the work is to be done should be stated in the contract. In addition, provision should be made for changes in payment if the scope of the assignment is fundamentally modified.

Many clients prefer the above method of compensation because they want to know the cost of a project before signing a contract. But, from the consultant's point of view, unless

，有本质上的改变时，得随时加以修改。

在工程和建筑管理的服务中，一种物质鼓励可以加在酬金中，而和为完工而预先订的一价格连在一起。若全工程之费用低于所预定之价格，则酬金便按比例增加，反之则按比例减少。

建筑管理之酬金，因工程之大小而异。小工程的3%到大工程的1%。

C4全部或单位总值金额：

在总值金额的付款体系下，在开工以前，顾问决定一固定数目的报偿。顾问通常用另外计算报偿的体系的方法来计算索款额。一个基本的关于偶然事故的条文，通常也加在里边，用以支付业务的风险。

工程的范围应正确的加以规定。工程应该完成的日期也应写在合同中。除此以外，也应注明，若工程范围有了基本上的修改，则付款也要随之而变。

很多顾客宁愿采取上述报偿方法，因为他们想在签合同以前知道工程所需费用。但在顾问的立场来说，除非工程范围能事先准确订定，不然，这种付款法有很大的风险。

the scope of the assignment can be defined accurately, this method of payment involves a high element of risk.

The unit lump sum price is applicable to repetitive work such as cartography of airborne surveys or work of this type, where a unit price may be established per map or per plan. Needless to say, the size, scale, degree of detail and colour scheme of the maps or plans must be precisely defined in the contract.

C5 Unit or global lump sum price, plus out-of-pocket expenses

This method is applicable to the same type of project as the preceding method and differs in that only the services are rendered on the basis of a lump sum price. The client absorbs the financial risk of the out-of-pocket expenses.

C6 Service at percentage of estimated or actual cost of construction, plus out-of-pocket expenses

This system is used for compensating consulting engineers for the preparation of designs, drawings, specifications and other documents which describe the facilities to be constructed. Construction supervision is frequently billed at cost. The basic assumption here is that engineering costs vary in direct proportion to the cost of construction.

Various fee schedules have been worked out which relate engineering costs and construction costs to certain types of engineering design. These schedules apply when design procedures and construction materials are more or less standardized. The fee varies with the size and type of the project, the difficulty of the engineering and the extent of the services required. Since these fee schedules relate specifically to construction projects within the

单位总值金额法可用于有重复性的工作，如空中测量的制图学，或这一类型的工作。其单位金额可建在一张地图或一张设计图上。不用说，地图或设计图的大小，规模，详细的程度，以及着色都需在合同中仔细规定好。

C5单位或全部总值金额，加上直接花费：

此法可用于与前法同类型的工程，唯一的不同是，此服务是建立在总值金额的基础上，顾客担着直接花费所可能有的财务风险。

C6服务佔建筑工程的估计或实际用费的百分比加上直接花费：

这体系是用于偿付顾问工程师的下列工作：设计的研制，绘图，说明及其他文件，用以描述将要建造的装备的。建筑的管理经常是按用费计酬，这儿基本的假设是，工程师用费是和建筑用费成正比。

在某些种类型的工程设计中，工程师费和建筑费不同的关系酬金表已被研制出来，这些表应用在设计过程及建筑材料多少接近标准规格的情况下，酬金依工程的大小和类型而不同，并依工程的难易及要求服务的多寡而不同，因这酬金表是与顾问所作建筑工程在某一特别

country in which the consultant is located, they must be adapted so as to be applicable to work done in another country.

The contract should specify whether the percentage is based on the estimated or the actual construction costs. In the latter case, an alternative payment method be stipulated in the event the work is abandoned.

If the fee is based on estimated construction costs, it may be established before beginning the final design. The consultant is thus not penalized for recuding costs through improvements in the final design. On the other hand, if his fee is based on "actual" construction costs, there is no incentive to reduce them as much as possible. Moreover, the contract should expressly state what is included and excluded from construction costs. Out-of-pocket costs may or may not be considered as part of construction costs.

Depending on the complexity and size of the project, detailed engineering fees may vary between 3 and 7 per cent of construction costs and the fee for complete supervision may range between 3 1/2 and 5 per cent construction costs, always excluding out-of-pocket expenses.

C7 Combination of these methods

In practice, the various methods of remuneration are frequently combined. For example, preliminary studies and preparation of an "avant-projet" can be remunerated on a per diem or salary cost times multiplier basis,

国度有关，所以要将它们改编后才能适用于另一国度。

合同应说明，这百分比是估计的还是确实的建筑费用的百分比。在后一种情形，一种另外的付款法应规定出来，而应用于工程半途而废者。

若酬金是按估计建筑费而算得，可能在最后的设计之改善导致的减少用费而遭罚款。在另一方，若他的酬金是按实际建筑费而算得，便不存在尽量减少费用的任何激励。不过，合同应特别着重指出，什么是包含，什么是不包含在建筑费用中。直接花费可以，也可以不作为建筑费用的一部份来考虑。

按工程的复杂性和规模，细列的工程师酬金可介于3%到7%的建筑费用之间，完全的管理酬金可介于3½%到5%的建筑费用之间，均在不包括直接花费的情况下。

C7 这些方法的综合应用：

在实际应用中，这些报偿的方法经常是联合运用的。例如：初步研究和研制—“AVANT-PROJECT”可按论件酬法或按工资乘以一因子的法子计偿，设计图的研制，和对同一工程的说明，

preparation of plans and specifications for the same project on a percentage basis and construction supervision on salary cost times multiplier basis.

Methods of Payment

Normally the methods of payments are based on the principle that the consultant does not bear the financial burden of the services he renders to the client. As the operation of the consultant consists mostly of salaries that have to be paid without delay, he must also be paid without delay.

Various procedures can be adopted to satisfy this principle. Most commonly a payment schedule is established at the time of the signature of the contract and the client pays according to that schedule with a monthly readjustment based on the actual amount of work performed to that date.

On per diem or salary cost multiplied by a factor methods, the consultant presents a monthly bill which serves to readjust the following months pre-established progress payment.

In lump sum or percentage basis contracts, the progress payment schedule is readjusted in accordance with a mutually accepted evaluation of the advancement of the work.

Examples of methods of progress payments are given in the appendices.

Regarding the currency in which payments are to be made, it is normal practice that services and foreign expenses are paid in the currency of the consultant's country, while the local out-of-pocket expenses are reimbursed in local currency.

可按百分比的方法，建筑管理按工资乘因子的方法。

付款方法：

正常情况下，付款方法是建在这样一个原则之上，即：顾问不负他提供给顾客的服务的财政担子。顾问的工作大部份是关工资的，因他需按时发出工资，所以他必需按时获得款项，不能延误。

多种的程序可实施以满足这一原则。最通常的情况是，付款时刻表在合同签字时即造好，顾客则按时间表，并按当时实际工作的进度作每月一次的调整后付款。

用论工件或工资乘一因子的方法，顾问每月需交出一清单，作为调整下个月份已造好的进度付款用。

在以总值金额或百分比为基础的合同，其进度付款表是按一双方均同意的，对工作进度的评价法，来加以调整的。

进度付款法的例子列于附录中。

对于付款所用之货币而言，正常的实际情形是，服务和国外的费用是以顾问所属国的货币发付，而当地的直接花费则用当地货币付之。

I am hoping this presentation has been useful to help you comprehend our contractual procedures and I will be very glad to answer to the best of my abilities any question you want to put forward on this subject. Thank you for your very kind attention.

我希望这篇文章能帮助你了解我们订合同的程序，我非常乐意尽全力回答你任何有关这题目的问题，谢谢。

THE CLIENT/CONSULTANT RELATIONSHIP

by

L. F. Wright

- Responsibilities of the consultant and of the client
- Mutual confidence and co-operation
- Code of ethics
- Scientific approach
- Effective communication and frankness
- Check of consultant's capabilities (be wary of consultants offering free services)
- Guidelines for an effective client - consultant relationship
- Evaluation of consulting engagements (include criteria)
- Advantages of the consulting approach over the turnkey contracting approach

A BASIC UNDERSTANDING OF EACH ASSOCIATES' ROLE AND
RECOGNITION OF THEIR CAPABILITIES, TOGETHER WITH
CAREFUL COMMUNICATION AND REASONABLE COOPERATION,
WILL ENSURE A RELATIONSHIP WHICH IS BOTH EFFECTIVE
AND EFFICIENT

顧客和顧問的關係

芮德

- 顧問和顧客的責任
- 互相信任和合作
- 道義的制度
- 科學的途徑
- 有效的聯絡和坦誠
- 顧問能力的檢查（注意顧問所給之免費服務。）
- 有效顧客和顧問的關係指南
- 顧問工作的估價（色拉背景）
- 利用顧問比較銅色商的益處

THE CLIENT/CONSULTANT RELATIONSHIP

In this presentation it is assumed that the client is a group or organization which requires consulting engineering services that are available from Canada and a Canadian engineering firm has been tentatively chosen as having the best experience to provide those services.

Let us assume that no previous work experience is available between the particular group and the engineering firm in Canada and, because of this, it is necessary to define the basics on which an effective relationship may be built.

To be selected, the Canadian firm has a record of operations and growth over a period of many years. A sampling of its projects has been reviewed and checked. Its staff is competent and well experienced in its specialized field of activities. Its staff is mature and stable as evidenced by the personnel resumes which indicate education, experience, years of service and ages. Its experience is well suited to the required work and the resumes of staff suggested as being available (or their equivalent) are admirably suited to the supervision of the work. The firm has submitted a pre-qualification proposal fully covering its capabilities and it has presented an outline of work to be done, its procedure for carrying out the work, a realistic schedule of activities and a target completion date.

顧客與顧問的關係

每成員對自己職責基本上明白及認識各自的能力，加上小心的往來與適當的合作，應會確保有效和有力的關係。

顧客與顧問的關係

在這文中，假定顧客為一組織或機構需要工程技術顧問的，而這些工程顧問是可從暫定最有經驗的加拿大及加拿大的工程公司取得的。

讓我們來假定該組織及加拿大的工程公司之間從未有工作關係，因此，有效關係的基礎定義是需要訂下的。

一間有多年經營及成長記錄的加拿大公司將會被選中，它一些工程計劃的樣本已被複閱及檢核過，它的工作人員對自己這門專業都有資格及良好的工作經驗，從這批工作人員的個人記錄指出他們個別的教育，經驗，年齡及工作的歲月，証明他們是成熟及穩定的，他們的工作經驗很適合工作上的需要，其個人記錄指出他們極可勝任工作管理之職，這公司已呈上一個其資格證明書，談及它的工作能力，將要

The client is satisfied that he has made a wise choice.

For the project to be satisfactorily carried out it is equally essential that the engineer understand the scope of work that the client is responsible for and be assured that the client fully understands the project and can meet all of his commitments.

It is virtually unknown for the engineer to have complete and absolute responsibility, without checks, because this is contrary to human nature and would normally not be in line with the client's need for involvement either for control or for educational purposes. Because of this, client involvement and the relationship that permits such involvement is all important.

Firstly, the consultant needs to be sure that the client fully understands his responsibilities and has competent capable staff to carry out all his commitments including:

1. Providing information competently and on time in order to prevent costly delays;
2. Making important decisions which are the client's alone and the delay of which would unduly delay the project;
3. Keeping the consultant informed of any changes which affect the project as quickly and accurately as possible;
4. Ensuring that he has both technical and financial personnel who can competently evaluate the presentations of the consultant, in order to strike a balance between technical nicety and the reluctance which a purely financial bureau may hold for the capital outlay which sound engineering may require;

做的工作大綱，工作上的各程序，一個有真實性的工作時間表及完工的日期。

顧客滿意自己作了一個聰明的選擇。

要工作計劃滿意的成果，工程師要明白顧客在責任上的工作範圍，同樣重要的是要令顧客完全明白這工作計劃及顧客的承諾能實現。

沒有核對，工程師實際上不知道其完全及絕對的責任和位置，這樣會自然變成不能符合顧客在管理上或教育上的目標，因此，顧客的參與及參與因素的關係都極重要。

首先，顧問需要弄清楚顧客完全明白他們的責任及其有資格和能幹的工作人員去履行他的付托，顧客的責任包括以下各點：

1. 充份及準時供給資料以防止糜費的阻滯
2. 下重要的決定是顧客自己的事，其遲疑會阻延工作計劃。
3. 如对工作計劃有任何更改，應即尽快及準確的通知顧問。
4. 顧客應有技術及財政人員以能適當地衡量顧問提意，作出一個精確技術及純財政付出資金代價的比較，這都是一個優良工程學所需要的。

5. The full extent and total cost of his (the consultant's) involvement.

In addition to the client responsibilities, the consultant's responsibilities begin with the responsibilities which must be assumed by any engineer and these are summarized by C. Frank Allan in his text "Business Law for Engineers", as follows:-

1. Engineering Skill Required

Where an engineer is employed in a private capacity, he undertakes to bring to his work the average skill of those engaged in a like kind of work. If he makes a specialty of some class of engineering, he undertakes to use the average skill of others who make a similar specialty in such class of engineering. He does not in either case ensure absolute accuracy unless, by custom, checks are possible and in regular use which will allow absolute accuracy to be secured.

2. What Service is Guaranteed

The engineer guarantees:

- a) Reasonable learning, skill and experience,
- b) The use of proper care and diligence,
- c) The application of his best judgement,
- d) Absolute honesty,

3. What an Engineer may Attempt

An engineer who never attempts work which he has not already demonstrated his ability to carry out is of little use in the world. Where the result of failure is likely to prove serious and the probability of success definitely doubtful,

5. 顧問的完全參與及其參與的價錢。

顧問的責任

除顧客責任之外，顧問的職責是所有工程師們應有的，而這些職責可從《法國巴黎的「工程師商業律例」一書摘要中來：

1. 工程師技能的需要

當一個工程師受顧於一私人公司，他一定要表現有水平的技術。如他專門於某一等級的工程，他應能表現其該特長技術的水平。除了習慣上，核對之後，否則他不必達到絕對的準確性。

2. 甚麼服務是受保證的

工程師保證：

甲. 合理的學識，技能及經驗

乙. 小心及勤懇

丙. 應用其最好的判斷力

丁. 絕對忠誠

3. 工程師會嘗試什麼？

工程師永不嘗試一些他從未表現自己能力而對世界無貢獻的工作。除非沒有其他比較好的方法及一定急需的，否則當工程師明白失

the engineer should decline the service unless the necessity seem imperative with no better alternative apparently available.

In general, the consultant's responsibility to his client, however, may be summarized as the responsibility to act for his client, in all his dealings, as an agent who is continuously aware of and who attempts to safeguard his client's interests, providing those interests are not in contradiction to his code of professional ethics.

It should, however, be remembered that it is impossible for an engineer or a client to be completely dispassionate or wholly unbiased in all their dealings. It is for this reason that no working agreement would be attempted without as complete a contract as may be conceived being first reviewed, discussed and accepted by both parties. Fairness and the ability to exchange priorities and objectives at this critical stage is essential to the establishment of the co-operation which is imperative in the successful progress of engineering projects. Mutual confidence germinates at this stage and grows if each party attempts co-operation throughout the life of the project. The client's confidence grows as he becomes aware of the consultant's desire to perform for him and to offer him fair and expert advice when it is needed. The consultant's confidence in his client is dependent on his willingness to fulfill his responsibilities promptly. It cannot be overemphasized that full understanding of the consultant's role is absolutely essential to the client and a reciprocal understanding of the client's requirements is likewise essential to the engineer. A misunderstanding on either side can produce many complications and inefficiencies in the eventual proceedings.

敗的嚴重惡果及成功的機會很微時，工程師應放棄其工作。

顧問通常對其顧客的責任大致上可摘要為在任何交涉上，要對顧客負責。身為代理，顧問要時常醒覺及保護其顧客的利益，但這利益對其職業道德和法紀上沒有衝突。

互相信賴及合作：

我們要明白工程師或顧客在任何交涉上要完全沒有感情衝動或完全沒有偏見是不可能的。因此，如合約未經雙方明白複閱，相議及接納，工作合同是不可能成立的（在這決定性的階段，討論和接受双方的平等和交換權力而又向著同一目標進行為工程計劃成功的必須條件）双方面在這計劃中試圖合作，互相信賴便會在這階段萌芽及生長的。如顧客知道顧問在需要時供給公正熟練的意見，他對顧客自然產生信心。我們不能過於強調完全明白顧問所當的角色對顧客很重要，而同樣地工程師明白其顧客也是重要。顧問對顧客的信心視乎顧客迅速的決斷。假使任何一方有誤解，這會在以後的事件上產生很多複雜的問題，和喪失效率。

Any engineering company resigtered as a consultant has normally accepted a code of ethics which has been developed for engineers as being relevant to the engineering profession. The morals and conduct that they define do no vary appreciably from one engineering fraternity to another and they basically define four relationships. These relationships are the duty of an engineer to:

1. His profession
2. The public
3. His fellow professionals
4. His employer or client

The first duty represents an attempt by engineers to maintain and optimize the usefulness of that profession by encouraging self-development and the development of other engineers by free interchange of information.

The duty to the public is a moral one which is based on social consciousness and an engineer's responsibility to his community,

道德的法化：

通常任何工程公司如登記成一顧問，需要接納工程行業建立的工程師道德法紀。所有工程師學會所定法則，不會有分別。基本地可下定義為四種關係：

工程師對以下各方面的職責

1. 其行業
2. 大眾
3. 其同業
4. 其顧客或顧客

職業責任：

工程師的第一件職責是經自由交換資料來鼓勵自己啟發及啟發其他工程師以保持及盡量利用專業的益處。基本上工程師對大眾是要有道德及社會問題的警覺，對社會組織、國家要負起責任。這方面的責任包括，對有關顧客的生活及健康，歸結要小心處理以免誤報，不公正、不真實或誇張的言文能導致對社會、國家及業主、顧客的利益有所損害。

工程師與工程技術公司之間的關係標準是用以維持職業的表現水準及阻止職業上的不盡

state or country. In this respect, responsibility is assumed for the life and health of the public and employees who may be affected by his work and consequently care is taken not to misinform. Unfair, untrue or exaggerated statements can do much to irreparably damage both social and national development and the employer's or client's interests.

The standards of relationship between engineers and engineering companies are designed to maintain the standards of performance of the profession and restrict professional irresponsibility. In this respect, public criticism of another's work and the reduction of normal fees to obtain unfair advantage are actively discouraged and the proper allocation of credit and the policing of unethical practice is an individual responsibility. When these facets of an engineer's ethics have been defined his relationship with a client may be discussed. Since these are important and, in fact, are the basis for the entire relationship, they are presented here.

The first five clauses are related to the obligations which the engineer or consultant has in order to maintain responsibilities to his client alone and define the singularity of loyalty that is essential for satisfactory relationships.

They are:

1. The engineer will act in professional matters for each client or employer as a faithful agent or trustee.
2. He will act with fairness and justice between his client or employer and the contractor when dealing with contracts.
3. He will make his status clear to his client or employer before undertaking an engagement if he may be called upon to decide on the use of inventions, apparatus or any other thing in which he may have a financial interest.
4. He will not accept compensation, financial or otherwise,

責。在這方面，公開對別人工作的攻擊，對通常收費的削減以求取不道德的利益是積極地阻止的。適當的名譽分配及不符合道德的業務行徑是個人的責任。這是工程師與顧客的道德關係所在。而實在亦是關係的基礎。所以我們要詳述如下：

有五條款項因乎工程師或顧問對其顧客的義務以維持對顧客的單獨責任及忠心以維持重要而滿意的關係。這些條約是：

1. 在職業性的事件中，工程師為每個顧客或雇主的忠誠代理或信託人。
2. 當處理一些合約時，在他的顧客或雇主和合約處理人之間，他將維持公平和正直的態度。
3. 在受雇之前，他將會對他的顧客或雇主解釋清楚他的立場，如果他要決定使用一些他可能發生財務上的興趣的事物，如一些新發明，工具或其他事物。
4. 未經所有同伴同意，他不能接受財物或其他的賠償，亦不能接受在同一工程上同時為多個集團服務或工作。
5. 他對任何影響其顧客業務或興趣的事務

from more than one interested party for the same service, or for services pertaining to the same work, without the consent of all parties.

5. He will promptly disclose to his client or employer any interest in a business which may compete with or affect the business of his client or employer. He will not allow an interest in any business to affect his decision regarding engineering work for which he is employed or which he may be called upon to perform.

The consultant must recognize his responsibility to adequately supply his specialized knowledge to the relationship and, where his knowledge is lacking, must freely acknowledge his shortcomings in this respect so that more relevant input may be obtained from other persons. These responsibilities are:

6. He will guard against conditions that are dangerous or threatening to life, limb or property on work for which he is responsible or, if he is not responsible, will promptly call such conditions to the attention of those who are responsible.

7. He will present clearly the consequences to be expected from deviations proposed if his engineering judgement is overruled by nontechnical authority in cases where he is responsible for the technical adequacy of engineering work.

8. He will engage, or advise his client or employer to engage and he will co-operate with, other experts and specialists whenever the client's or employer's interests are best served by such service.

Finally, his absolute honesty and straightforwardness is a definite requisite:

都立即止告，而不會因個人興趣而影響顧客業務。

顧問一定要瞭解他的責任而充分地供給這個關係他的特殊知識，同時，當發覺自己知識不充份時，應坦白承認自己的困難，藉以吸收其他人士在這一方面忠告。

這些職責是

6. 他是要提防所有危險的，或危及生命，手足或財產的情況，發生於他負責的工程，或如非他負責的，要立即將這等情況通知負責人。
7. 在他負責而需求充足的技術的工程中，如果他在工程上的決定被一些非技術性的高層人士推翻時，他將會清楚提出因這不同之見解而可能引起之後果。
8. 當他的顧客或僱主所提出的興趣是最適合接受某一些專門人員的服務時，他是會僱用，或提議他的顧客或僱主僱用，此等專家或專業人士，同時他會與他們合作。

最後，他的絕對誠實和始終忠誠是一個非常肯定的先決條件：

9. He will disclose no information concerning the business affairs or technical processes of clients or employers without their consent.

10. He will not accept commissions or allowances, directly or indirectly, from contractors or other parties dealing with his client or employer in connection with work for which he is responsible.

11. He will not be financially interested in the bids as or of a contractor on competitive work for which he is employed as an engineer unless he has the consent of his client or employer.

While the above list is long, its content may be accurately summarized as integrity, honesty and fidelity. It has been suggested that while a consultant has a clearly defined code, this is not true for a client and that its composition would be extremely valuable to the development of satisfactory relationships. The suggestions are itemized as follows:

1. The client will select engineers on the basis of merit in accordance with accepted practices.
2. The client will pay adequate and equitable fees to the consulting engineer for his services.
3. The client will accept the consulting engineer as a professional advisor and extend to him the respect and confidence warranted in such a relationship.
4. The client will accept responsibility for the consequences to be expected from proposed deviations from the consulting

9. 沒有他的顧客或僱主的同意，他不會向別人透露任何他們商務事情或工業過程的消息。
10. 他不會直接或間接地接受合約簽署人或其他與其工作有關而其僱主交易的人所支付之佣金或津貼。
11. 如果沒有他的顧客或僱主的同意，他不會在財務上對工程的投標或合約處理人或生興趣。

顧客的道德：

上列冗長正確地撮要可成正直、誠實和可靠，另一提議是在顧問有清楚完整的規條之下，而顧客應遵如下建議以確保滿意發展，這些建議可分列如下：

1. 顧客可基於他們在所需知識中的特長而選擇這些工程師。
2. 顧客應因他們的服務而支付足夠和公平的費用給顧問工程師。
3. 顧客應視顧問工程師為專門顧問，而時其尊重和信任。
4. 如他的見解與顧問工程師的提議有分歧

engineer's recommendations.

5. The client will promptly furnish the consulting engineer the information and data that he requires and will promptly review and approve the information and recommendations submitted by the consulting engineer.

6. The client will give credit to the consulting engineer for his part in the engineering work.

7. The client will respect the consulting engineer's position with respect to contractors and material suppliers on construction work and will not bypass him by going directly to the contractor.

If this code is accepted, then it is possible to summarize it, also in three words - honesty, integrity and support. It will be noted that honesty and integrity occur in both summaries and nothing can contribute more to effective relationships.

As well as the consultant, it is normal for the client to have a technical background. This background and training are considerable assets in developing the client/consultant relationship since they allows for the precise, accurate transfer of information throughout the life of the project and orderly planning which is vital to development of the project. At critical stages throughout the association, probably at the start and at the completion of each major

，這顧客將要承擔因此歧見而引起的後果。

幻灯片—顧客的道義

5. 顧客要立即供給顧問工程師所需的消息和資料，同時要立即翻閱和評定顧問工程師所提出的資料和建議。

6. 顧客循顧問工程師的工作而給予信用。

7. 顧客要尊重顧問工程師與工程的營造商和材料供應商之關係，同時不會超越他而直接与營造商聯絡。

科學的途徑

若這制度為接受，其撮要是誠實、正直和充份支持。注意誠實和正直在兩個撮要都存在，此為有效關係的要素。

與顧問一樣，很正常地顧客要有技術背景。這背景和訓練是一個很好的車錢以發展顧客和顧問的關係，因為在工程計劃的過程，它會使資料能精確地傳送和有秩序地計劃。這對工程進展有很大的幫助。在合作過程中的緊要時期，通常在開始和每個重要階段的完成，每個人員應非正式地檢討他們所用的計策，藉以交

step in the project, a review, however informal, should be made by each associate of methods used for the exchange of information. The consultant must be absolutely sure that his client is well informed and, probably what is more important, that the information he is given is properly interpreted. In this respect, techniques developed for use in technical management are invaluable whenever they may be used. Critical path methods, linear programming, cost and profitability presentations and regular progress reports should be prepared in preference to hastily scribbled memoranda or a host of letters. They may be filed and retrieved easily, are conveniently circulated for discussion and do much to ensure efficient and accurate exchange of information. The client should, at all times, request any information that he feels is lacking or any supplementary information that is necessary for more complete understanding. It often happens that a client may not have been subject to the workings of a formal engineering system before and, in fact, many clients who are producers employ engineers on their staff who have specialized in the solution of production problems but have not previously been involved in evaluation or construction.

In this case the consultant must be aware of this and must make every effort to provide the client with the opportunity to learn procedures. Recent industrial history in South America is illustrating the importance of this approach. For many years, the very important mining industry of those countries has been developed by foreign technology with little or no involvement of the personnel of the countries with the result that a technology gap has been created. In order, however,

換資料。這時顧問要絕對清楚所有消息都傳給他的顧客。而更重要是資料需正確地傳達。在這情況下。這些工業管理的技術。是十分寶貴的。重要途徑之方法 *CRITICAL PATH METHODS* 單次的計劃程度 *LINEAR PROGRAMMING* 成本。利潤的指示。和正常進度的報告應較一般臨急草議備忘錄。或大堆信件為佳。檔案需要存放取達方便以備分發討論。並藉以保證消息有效和準確地傳送。顧客要時常詢問他認為缺乏的資料。或請求對資料以更深瞭解。常有的是。顧客或從未作驗過正式工程系統的進行。而事實上。很多是立品商的顧客。他們僱用一些對這些立品有專門認識的工程師。而他們本身則從未對立品作估價或製造。

坦誠

在這情形中。顧問一定要醒覺及尽可能供給顧客機會去知道工作程序。近代的南美工業史正是指出這趨向的重要性。經過很多年的外國技術團至這些國家中為其最主要的工業發展。然而這些國家本身的人材很少參與這些發展。導致技術上的隔膜。為了達成顧問能做到這

that a consultant may fulfil these obligations, the client should attempt to inform him of his previous non-involvement with this aspect of the industry. If the reverse is true and the client has considerable experience in the work that the consultant must do, it is also important that the consultant is made aware of this and, at a very early stage, guidelines must be provided whereby the client's involvement in engineering recommendations is established. The consultant has a very strong obligation to attempt the implementation of his recommendations where he feels that the possible consequences of their rejection are sufficiently serious. In these cases the authority of the client must be sought from the beginning of the association. In this way the consultant may best fulfil his responsibilities.

When first the potential retainer of a consultant attempts to evaluate the qualification of the companies offering services, it is necessary for him to approach the selection methodically.

He should initially define in his mind the scope of work that is required of the consultant. This will identify the discipline involved and will, of course, narrow the field considerably. The next stage of enquiry is to ascertain, through experience or enquiry, the names of those consulting engineers who have suitable qualifications. It is necessary to remember in this respect that, as well as specialities, consulting engineers vary in the scope of their work. Some are prepared and equipped to accept smaller assignments while others would be too large to offer an economic service for smaller projects. It is also true that some consultants are experienced in foreign work while others may only court domestic involvement. All these factors must be considered, after which a short list of possi-

義務。顧客應讓顧問知道他以前對該工業的沒有參與。相反來說，如顧客對該工作有相當經驗時，顧問應留意這點。他要設法在早期便讓顧客參與及提供工程上的意見。當顧問感覺到如他們拒絕顧客的提意會引起嚴重的後果。這正是顧問的重要義務去實現讓顧客提供其意見。在這事例中，顧客一定要自組合開始時便爭取其權力。這樣才可使顧問盡其職責。

顧問的能力

當準備聘請顧問的顧客要衡量顧問公司的資格。他需要有方法地去選擇：

檢核顧問的能力——顧客開始便要下定其需要顧問的工作範圍。這會分辨出有關的規章及縮窄工作範圍。第二步驟是以經驗來斷定或詢問那些有資格的工程顧問的名稱。我們要記著，在這一方面，以及其專長之一面，不同顧問有不同之工作範圍，有些顧問是準備及訓練去做小規模之工作，而有些却因慣做大工作而不會理會小規模之工作。這是真的。有些顧問對國外工作有經驗，而其他則對國內工作有經驗。這一切原因定當要考慮，因過後一小可能

bilities will exist. It is at this point that the individual capabilities of each consultant must be closely examined. Previous and recent clients of each potential consultant should be contacted to determine the performance of the consultant. If necessary, inspection of the consultant's completed engineering projects by technical personnel would be valuable and would assist in further reducing the list.

The results of many consulting involvements are difficult to assess - feasibility reports for example, are often confidential and may not be viewed by a third party. It is also difficult to assess the accuracy of the content. For these evaluations it is necessary to interview the consulting engineers being considered and invite a proposal and personnel resumes. An accurate perspective of integrity and experience must then be attempted before full selection may be made.

The proposal should include an outline of the studies of work that the consultant would undertake, if selected, and the cost to the client. The client should investigate and justify, as far as possible, the work in terms of the activities involved and the time to be spent on each. If he has no experience in this type of evaluation, he might well be advised to seek the assistance of an impartial consultant, should the project be

入选顧問列表”會出現。就是在這一裏，個別顧問之能力定當要仔細地查察。每個有能量之工程師的以前及近況，顧客應當詢問，繼而用之去評量工程師之工作效能。如果是需要的話，派遣專業人才去視察顧問已經完竣的工程會有裨益及幫助縮短“可能入选顧問列表”。

很多工程之結果是難以評量。比例說：“可以實行的報告書”是通常被視為秘密，不給與第三者察閱。同時，去衡度報告書中之內容之準確性亦是很難办到的。面試被考慮中之工程顧問，察閱其自己之提案及個人之工作經驗是必要的步驟去評量顧問。在全面性之選擇之前，準確的衡量顧問的率直及工作經驗是應該嘗試。

衡量顧問之工作

提案中要包括一個顧問之工作大綱。同時如果被選中的話，顧客所需要付予為若干。顧客應徹底審閱及証明工程之每一行動，及其所需時間。如顧客對評量工程缺乏經驗，便應催請公正的顧問來幫助，當然該工程應視為重大。

sufficiently important to justify it. After selection, the progress of the project should be evaluated periodically and compared to projected performance and costs.

An important evaluation is that which should be performed by the consultant before submitting his proposal. He should be completely aware of the scope of his involvement. Underestimating the extent of the work with the resultant errors in cost estimating can severely strain relationships in later stages. It is the responsibility, therefore, of the client to be extremely precise and complete in the information that he supplies regarding the project scope.

There are, in general, two types of relationships for which a client may retain the services of an engineer. Each involves a different service and different responsibilities on the part of the engineer. In the discussion so far, the consulting approach has been considered in which the engineer acts as the client's advisor and, in good faith, as his agent or trustee. Since his first responsibility is to the client, there are generally considerable advantages to be had in obtaining a service which is as free from bias and which is as committed to economic and efficient execution as may be. The alternative approach, a turnkey contract, is a contract in which the engineer covenants to deliver a producing or manufacturing plant which is designed, constructed and brought to production for a fixed sum, with little or no client input. There are some advantages to this seemingly attractive propo-

，因僱請顧問亦是一項開支費用。選擇顧問之後，工程之進展應該周期性地衡量，同時，用之去比較預算案之工作效率及費用。

一個重要的工程衡量，应在顧問呈交提案之前，交由顧問辦理。顧問應該完全知道他工作範圍，估計工作範圍之錯誤會導致工作費用之估計錯誤。這樣一來，便大大影響顧客與顧問間以後的關係，所以，顧客之責任就是供給與顧問凡有関連工程的最正確及完整之資料。

顧問衡量法之好處

通常有兩種關係使顧客能續用顧問，每種關係皆包含顧問之不同任務及責任。在這個討論中“顧問衡量法”就是說顧問之任務是為顧客之忠告者，及忠實地做其評議者或代理人，正因他的首要責任是對顧客，如果取得一些服務是能盡量避免有偏見存在和盡量使用經濟和有效的行政，通常是有很好處，另一個途徑，一個敲鉗 TURN-KEY 合約，是工程師規定之合約。而在少量或沒有顧客幫助之情形下，設計建造一間食品製造廠以供給定量的食品。在這表面很吸引的建議，它有一些好處和一些必然的壞

sition and some very definite disadvantages. It is obvious that if a consultant engineer were commissioned, for instance, to design and build one car then the cost would be very high. A car is, however, on a turnkey basis and the engineering costs are well distributed over many identical units so that engineering costs are negligible. The same principles apply to producing plants which are basically identical, and some chemical plants fall into this category. Ammonia or liquid air plants may often be purchased to advantage in this way. In the majority of cases, however, plants are designed and constructed for an unique set of circumstances or may even be the only plant using a specific process. In these instances there are distinct disadvantages to the contracting on this basis. It is evident that in a turnkey contract the engineer is accepting the risk of construction and, because of this, final costs are generally higher. It is also unrealistic, because of the now diverse nature of his interests, to expect an engineer who is allied with a contractor to maintain an objective professional viewpoint towards the owner's interests despite normally irreproachable ethical standards. If the client's preference or local customs are such that, in fact, a turnkey contract is necessary, initial discussion between consultant and contractor must ensure that it is understood that the engineer will be guided by the principle of good engineering practice and professional ethics and that his responsibilities to the client will remain unchanged. It is, however, normal in some countries to retain consultants on the conviction that, as a company agent, the engineer can perform more effectively and if the turnkey contract is finally chosen it is often considered to be valuable to retain a consultant to act in the capacity of company agent and

處，明顯地，如果一個工程要收佣金去設計和建造一輛汽車，那麼成本會很高，但一輛車是在啟釧 TURN-KEY 基礎，工程費用是分散在相同的零件，所以工程費用可以不作理會，同理可用在典型的食品工廠，和一般同類型的化學工廠，亞摩尼亞或液體空氣工廠亦可用同樣方法而獲得好處。但在大多數情形下，很多工廠是因為別不同的環境下設計和建成，或甚至是唯一用某特殊進度的工廠，在這些情形下，對於此類的建造有特別的壞處。很明白地，在一個啟釧合約，工程師要冒險建造，因為這個最後的成本通常是比较高，這是不切實際的，因他興趣的轉變，而認為一個與營造商合股的老工程師，能不管道德標準，對物主的興趣維持客觀的職業觀念，若顧客認許或其習俗為如是那末啟釧合約便可行，那麼顧問和營造商的初步討論一定要保證工程師應有好的學問和職業道德，同時，他對顧客的責任將保持不變，在一些國家，顧問變志是通常被判罪的，無論如果作為公司代理人，工程師能有效的工作，同時的啟釧合約最後被選定，那麼保留一個顧問，在公司代理和計劃監督間工作是認為是極有

supervisor of the project.

In summary, a satisfactory relationship between a client and his consultant is one which will involve much care in its establishment. A consultant must be aware that his client has unique requirements and that he may be unfamiliar with the procedures that are required. As well as being a specialist in his particular discipline, the consultant is also a specialist in his branch of that discipline which is consulting engineering; as such his is the responsibility for ensuring that his experience in the cultivation of such a relationship is used. A tolerant and patient approach and the realization on the part of the client that the consulting engineer is himself an entrepreneur who takes the risks of his own business enterprise and assumes the responsibility for his often considerable office staff, will undoubtedly provide a sound basis for that relationship.

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有價值的。

顧客和顧問間有效關係之指南：

總結來說：顧客和他的顧問間有效關係倚賴在著重它的成立。顧問一定要注意他的顧客的特別需求和他可能不熟識其步驟。除了特長之外，顧問要這特長的專門顧問。這麼他有責任保證他的經驗是用在研習這種關係。中肯來說而顧客亦需知道顧問工程師應以人比己。正如替自己負起一切上商險責並負責看護所有的工作人員。這才能為其對僱主關係樹立楷模。

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INTEGRATED CONSULTING SERVICES
(PROJECT MANAGEMENT)

by

R. A. Pillman

- Advantages of project management concept
- Economic services (economic planning, forecasting, etc.)
- Feasibility studies (preliminary design and estimates)
- Engineering development and design and preparation of tender documents
- Evaluation of bids and recommendations
- Procurement and supervision of equipment manufacturers
- Supervision of civil engineering construction
- Equipment erection and connection, start-up and commissioning
- Operation and maintenance manuals
- Training of staff (superintendent, foreman and operators)
- Training programs

集成顧問服務(工程管理)

舉文

- 工程管理觀念的優良
- 企劃勤務(經濟計劃, 預測等)
- 可能性研判(初步設計和估價)
- 工程發展, 和設計及制備標文件
- 評定標價和推薦文件
- 購置設備和監督設備製造商
- 監督土木營造工程
- 設備的裝設連接, 發動和服勤
- 操作和保養手冊
- 人員訓練(主任, 領工, 和工人)
- 訓練計劃

PROJECT MANAGEMENT

Project management is the term often used to describe integrated services provided for a project.

Under this definition the extension of consulting engineering services to include all possible such services constitutes project management. This definition is widely used, but it is neither correct nor adequate.

Project management is, in essence, a philosophy and a method of controlling a project. It may well encompass a complete list of services but these do not constitute project management. It is the philosophy and the method of control that makes project management stand out as a significant management system, a very successful management system.

Project management is best approached by considering first other systems that are used to manage projects and differentiating among them in the contexts of objectives of the participants and the types of projects that are being managed.

Therefore, this paper is presented in two parts. Part A deals with the various management systems and their application; Part B with project management, its philosophy and methods.

PART A

MANAGEMENT SYSTEMS

I. Types of Projects

It is useful to start by identifying the types of

工程管理

工程管理一詞，常常用來述說工程的集成勤務。根據本定義，工程管理可認為係顧問業務的擴大，包含各種可能勤務在內。雖然本定義廣泛地為人採用，但是就定義而論，它是既不正確，也不適當的。

簡而言之，工程管理乃是一門哲學和一種控制工程的方法。它誠然包括全套勤務，但是這並不即構成工程管理。工程管理之所以卓然成為一種重要的管理系统，就因為它是一門哲學和具有獨特的控制方法。

研究工程管理学之先，應當考慮其管理工程的方法，然後按照下列觀點加以區別。這些觀點為：參加人員的目標，和工程的種類等：

因此本文分為兩部宣讀。甲部討論各種管理系统及其應用，乙部討論工程管理学，哲理和方法。

甲 部

管理系统

1. 工程種類

開宗明義，我們應當把考慮的工程，指認

projects that we are considering and placing them in categories.

The first category I would identify as the PUBLIC WORKS AND UTILITIES category. In this I would place, among others:

- Highways
- Rapid transit
- Airports
- Hydro-electric generating stations
- Thermal electrical generating stations
- Railways
- Telecommunications

The second category I would call the LARGE or HEAVY INDUSTRY category. This would include:

- Steel mills
- Metal smelters and refineries
- Oil refineries
- Petrochemical plants
- Chemical plants
- Pulp and paper mills

There is also a third category, I would call the SMALL AND MEDIUM INDUSTRY category. This would include:

- Most secondary industry
- Automobile assembly plants
- Some electronics plants
- Appliance manufacturing
- Food processing, and so on

出來，然後加以分類安置。

第一類可指認為公共工程 and 公用事業類。

本類包含：

公路

快速公路

機場

水力發電站

火力發電站

鐵路

電訊

第二類可稱為大規模或重工業類。本類包含：

鋼鐵廠

金、銀、銅、鋅廠

煉油廠

石油化學工廠

化學工廠

紙漿、製紙廠

第三類可稱為小規模或中型工業類。本類包含：

大多數輔助工業

汽車裝配工廠

Projects in each category have characteristics which tend to be common with the category.

The Public Works and Utilities Projects:

- a) Are usually, although not always, state owned by some level of government, federal, provincial or municipal.
- b) Are often large in terms of capital cost, that is, \$50 million or more up to \$1 to \$2 billion.
- c) Contain a large proportion of civil works, that is, excavation work, concrete structures, etc. -- work that involves much local cost in contrast to manufactured equipment or shop fabricated structures that require large and often sophisticated manufacturing facilities for their production. This is not to say that these "equipment" portions are insignificant -- quite the contrary, they are often as large as the projects themselves -- but only that the civil works are even larger in proportion.
- d) Require implementation periods, that is, period for design, procurement and construction that are measured in years, usually two or more, sometimes six, eight even 10 years.

The Large or Heavy Industry Projects:

某類電子工廠

電具製造工廠

食品加工廠等

各類裏面的工程具有共通的特質。

公共工程和公用事業工程：

a. 本類工程通常為國有的，由各级政府經營。例如：中央、省或市政府。

b. 通常資金成本龐大，5千萬元以上可達1-2億。

c. 包含大部份土木工程，如掘土、混凝土結構等。本類工程除開製成的設備以外，還包含許多在當地施工的工程。製成的設備通常在工廠內製造需要許多複雜完備的機器才能製成。上述“製成的設備”并非無關重要，相反地它們佔工程資金的大部份，只不过當地施工的工程，資金數更大而已。

d. 需要敷設時間，也就是，設計、購置、建造等的時間，它們通常以年計，通常兩年以上，有時六年、八年甚至於十年。

大規模或重工業工程

- a) Involve capital investments measured in tens and hundreds of millions.
- b) Are usually privately owned (except in socialist countries).
- c) Often require proprietary process and other special know how.

The Small and Medium Category Projects:

Have characteristics similar to the large and heavy industry projects.

II. Contracting Approaches

Let us consider the various contracting approaches: PROJECT MANAGEMENT, PRIME CONTRACTING, TURNKEY, and see how they differ from each other and from TRADITIONAL PRACTICE?

Traditional Practice I would define as the one practised by many public works and utility departments, such as electric power departments, and by many industries in designing, equipping and constructing facilities for their purposes. Typically, the owner instructs his employee engineers or retains consultants to prepare designs and specifications and then construction drawings for the project. Bids are solicited for various items of equipment to be installed and a little later bids are solicited for the general contract, which covers installation of equipment and construction of civil works, the provision of access roads, the excavation, the supply and placing of concrete and the erection of structures. On complex

- a. 投資額通常以千萬或億元計。
- b. 通常為私有企業(但社會主義國家例外)。
- c. 通常需要專利製造過程和其他特別技術

小規模或中型工業工程
特點與重工業工程相同

II. 合約進行

進行合約有各種方法：工程管理，主要合約啟銷合約等。現在先討論它們與傳統的包工方法有甚麼不同之處。

傳統包工方法：

這種包工方法可定義為許多公共工程和公用事業(例如電力部)和許多工業界，在設計、裝置、和修建設備時所實行的包工辦法。標準的作法如下：設備所有人指示他雇用的工程師們或聘請顧問人員去準備好設計和規格。然後綜結為工程圖。所需要安裝的設備招商標價。稍後再招標一家總包商。承裝設備和修建土木工程。道路。掘土。堅立混凝土結構等。在複雜

projects it is common for the general contractor to subcontract some of the work, often much of it, to specialized contractors.

The role of the engineer, be he an employee of the owner or a consulting engineer, is to prepare economical designs and then to act as policeman over the general contractor with the object of ensuring adherence to specifications, guarding against poor materials and workmanship. Construction procedures, and techniques, however, are left almost entirely to the contractor -- a contractor whose objective is to make a profit; a contractor who had a few weeks at most to plan his work before submitting his bid; a contractor who is experienced in construction techniques, but who was not consulted about these techniques by the engineer when he prepared the designs.

Only after being awarded the contract does the contractor have a chance to do solid planning of his work and naturally he will do it for his own benefit. He has already agreed to the prices he will be paid by the owner. Now is his chance to improve on his procedures, perhaps save on time, but above all hold on to the contingencies he included in his bid and transfer these to the profit column.

Project Management is a philosophy and system which was developed in recent years with the purpose of overcoming the disadvantage of traditional practice. Too many case histories of projects out of control, projects with large cost overruns, exist to attest to the ineffectiveness of traditional practice. The owner cannot help but be unhappy at the financial result. And, of course, where the

的工程裏。總包商一般把大部份工作轉給專業小包商。

至於工程師的任務（不管是他雇用的或者聘請的），總是先做好經濟的設計然後再監督總包商要求，工作符合規格，防止偷工減料。但是施工的程序和技術差不完全讓包商自己作主。要知道包商的目的是賺錢，在投標之前他只有幾個禮拜的時間作計劃。他在建築技術上具有經驗，但是當工程師設計時並沒有諮詢他的意見。

只有當他得標以後，他才有機會去踏實計劃他的工作。當然他作計劃時處處著眼在賺錢，他已經同意了標價。現在輪到他要改進他的程序，藉此省工來賺錢，但是必須符合他標單上的條件。

工程管理是一門哲學和一樣系統，它是近年才發展起來的。目的在乎克服傳統方法的缺點。過去有不少的工程案例：工程支了樣，工程超支預算等，都証明了傳統方法的無效。業主最後只有對著一堆溢賬嘆氣。當然也有業主態度強硬的，那麼包商只有走上破產的一途。

owner has been tough there have been bankrupt contractors, lots of them.

Under the project management procedures, as applied generally to large projects, the owner acquires or retains a project management team that is experienced in management of engineering, in cost estimating, in construction planning, in procurement, in control systems, in financial planning, in all aspects of major projects. This team begins its work early, well before any contracts are sent out to bid, makes detailed comparative studies of alternative construction techniques and selects the most appropriate. It then cuts the project up into contract packages that are controllable and most appropriate (this is a major planning study in itself).

Each contract package has its budget established (again a major exercise). Only at this point is detailed engineering commenced. And engineering is not permitted to be a law unto itself, a work of genius, a work not to be questioned. Estimators re-estimate each contract package as detailed designs proceed and designs that result in costs higher than budget are sent back for another approach.

Contractors for the contract packages are usually carefully pre-qualified. Contract content scope is carefully planned so that it is clean and straight forward and within the experience of well-established specialized contractors. Every effort is made to remove uncertainties

這種例子，多得不勝枚舉。

但在如果採用工程管理法(通常適用於大規模的工程)，業主便聘請一個工程管理組，他們在下列方面富有經驗：工程管理，成本估計，修建計劃，購置，控制系統，財務計劃，和所有主要工程的各方面等等。還在招標以前，他們就開始工作，詳細地比較各種修建技術然後選出最合適的一種，他們再將全部工程分成許多最合適和最容易控制的單位，每一個單位可以獨立招標。(這項工作本身便是一宗主要計劃工程)。

然後確定每一個單位工程的預算(本身也是一項主要作業)。到了這一步，詳細工程計劃才開始進行。當然工程計劃並不能舉為法典或作天才的工程，不容懷疑的。當詳細設計進行時，估計者再重新估定每一個單位工程的底價。如果設計的結果，成本超過底價，那麼便將該設計退回，重新設計。

每一個單位工程投標商的資格也預先仔細地規定清楚，投標範圍仔細地計劃好，文字要求相向和直接了當。任何干這一行而且信譽好的商家都能明白，盡量去掉不確實和有風險(指

and risk and thus obviate the need for bidders to include large contingencies to cover these risks.

That is a bare sketch. There is, of course, a great deal of technique as well as more to the philosophy of the system.

Prime Contracting. Usage varies but in our context prime contracting, as the name implies, refers to the practice whereby a contractor assumes responsibility for all, or at least most, of the elements of a project. He may thus have included in his contract not only all work of a general contractor, but also the procurement and installation of manufactured equipment and sometimes even the detailed design. Contractual arrangements can vary all the way from cost plus to firm lump sum.

Turnkey. Again usage varies. What is usually meant by turnkey is the practice of including under single contract responsibility, the design, procurement and construction of all elements of a project including start-up and initial operation. When the project is finished and operating the key is turned over to the owner. Hence the term. Commonly, payment would be on a lump sum basis, but many variations are possible. The terms turnkey and design and construct are usually considered to be synonymous.

There are many variations in content and actual arrange-

成本)的設計。希望投標商在標價時可以免掉開列一大筆額外費用。應付這些風險。

以上所論不過是舉其要者。至於哲理和技術細節。則不是本文可以申論的。

主要包工。主要包工一詞。解法頗有分歧之處。本文所指的乃是包商負責承包全部至少大部工程的一種包工方法。因此在合約內。他不但要包含總包商的工作。而且要負責購置和裝設制成的設備(有時甚至於包含詳細設計)。合約內容也變化很大。以工程成本到工廠攤費。應包含在內。

啟鎖包工。本名詞的用法也頗有分歧。普通所指的是一種包工方法。規定在一件單獨契約責任之下。負責設計。採購。和修建一宗工程的每一部份(包括開動和初期作業在內)。當工程完成和運轉以後。便把鎖匙交給業主。待他去啟鎖。本法因此得名。普通付款方法係付一筆總款。但也有其他付款方法的。通常“啟鎖包工”和“設計及修建包工”二個名詞被認為是同義詞。

但是啟鎖包工在內容方面和實際安排方面

ments in what appears on the outside as turnkey contract. It may, for example, consist only of supply of design and supply of equipment under a single contract, leaving out even that large element of construction at the site. This might be done, for instance, on a project undertaken for a socialist country which normally prefers to attend to all local aspects with its own forces, drawing on the foreign contractor only for some supervision of equipment installation. This is hardly a turnkey contract in the full sense, but it is common for contractors who are known as turnkey contractors to undertake such a contract.

III. Application of the Contracting Approaches

Now that we have definitions I would like to discuss the application of the various contracting approaches -- when to use which and why.

First a word about risk taking. An owner who is experienced in creating projects and really knows what he is about, in most circumstances plans to achieve his project goals at a pre-determined economic cost. He should not be striving for the lowest possible cost. Completion on time and reliability should be more important to him than the ultimate in savings on purchase price.

The wise owner knows also that if there are unknowns in his projects, such as uncertainty about what is under the ground, what the shovel will turn up when it starts digging,

变化很大。往往在外表看起来像是一件敲钹包工，而实际上只包含在一件单独契约之下。设计和供应设备而已。至于在“工地修建”这一大宗工程则不包含在内。这种方式，社会主义国家颇多採用。它们願意用自己本身的力量從事工地修建工作，只靠外國包商監督安裝設備。就全義來講，這種方式的包工，很難稱為“敲钹包工”，但是本業的商人也習見為常了。

四. 各種包工办法的应用

上面我們已經有了一些定義了。現在我想討論一下各種包工办法的应用。何時？何種？為何？

首先講一點“風險”。一個對於開拓工程具有經驗而且胸有成竹的業主，在大多數情形之下，都是在預定的成本之下計劃完成他的工程目標，他不應當只圖達到最低成本。工作如期完成和品質保證才是更重要的事。至於最後在購價中省了一點錢，則反而比較不重要了。

明智的業主也知道在工程中如果有些未知因素，那麼他就應當承擔起責任。這些未知因素例如：地下層的情況。掘土鋤挖下去會挖出

uncertainty about labour supply, uncertainty about taxes, any number of factors that could increase costs, that he the owner is the one that should take this responsibility. For as soon as he delegates risk taking to someone else such as a contractor he realizes that the contractor must cover the risk in his bid price in the form of a contingency and that once that contingency is in the price the owner pays for the risk whether or not it actually materialises as a cost to the contractor.

All owners should be so wise and experienced. This is not the way it always is. Owners, like everyone else, are prone to human frailties. They like to get something for nothing, to feel they have got a bargain when they may have actually paid more than necessary.

Now as to application of the CONTRACTING APPROACHES:

Traditional practice is fine for straightforward projects and for projects where the control of cost and schedule are not of prime importance.

Project management finds its greatest application in large, complex projects, especially those of the PUBLIC WORKS AND UTILITIES category. These projects usually contain a large amount of civil works, involve considerable uncertainty and extend over a number of years. The project management approach permits the owner to retain flexibility and control at the same time to the extent he desires.

Project management applies equally well to the LARGE AND HEAVY INDUSTRY projects and is used extensively in this category.

來甚麼，勞工來源，稅務，任何可增加成本的因素等。因為一旦他把這“風險”轉交給別人，例如承包商，那麼他就應當認識到承包商必然會將這項“風險”報在標價之內，列為雜支項目開支，其結果仍然是業主負擔風險，姑且不論該雜支是否實在是承包商的成本。

照說，業主應當是明智而有經驗的，但事實上並不常常如此，業主也同常人一樣，都具有人性的弱點，他們都想不費而獲，往往他以為自己賺了，而實際上却多支付了。

現在要談談如何實行合約之進行

傳統包工辦法，本法適用於簡明的工程，和某類的工程如它的成本控制與進度都不十分重要。

工程管理，在大規模複雜工程裏面，應用最廣，特別是公共工程和公用事業類，如前所述這一類工程包含有大量土木工程，許多未定因素，工程期限往往延長許多年，本法使業主能夠控制裕如，進退隨意，本法也適用於重工業工程。

Prime contracting applies best to projects on which most of the work can be done by the prime contractor himself, for example, highways projects.

Turnkey finds its best application in large and heavy industry projects, such as chemical plants, which usually involve some proprietary process and other special knowhow; which contain a high proportion of manufactured equipment; and which can be constructed in a period short enough to enable both manufacturing and labour costs to be predicted with reasonable certainty, such as, say, two years or so. Remember that to protect himself the contractor must assume the worst and that the owner pays whether or not the worst transpires.

In its simplest form a turnkey project would be called for on a basis of a performance specification, that is, a simple statement of the product to be produced, the output or quantity of product required to be produced, and the date when the plant must be in commercial production. The turnkey contractor would be free to select and bid on whatever process he considered most appropriate and would design the plant around that process, using whatever types of material and construction he considers most suitable for the purpose. The turnkey contractor would bid a firm lump sum price for the entire project and he may accept penalties for late completion and for any shortcomings in output.

In a firm, lump sum turnkey arrangement, until the project is fully completed and turned over to the final owner, the turnkey contractor, in essence, acts as an interim owner. The only difference is that he will not have to live with the plant for more than a few weeks or months after it

主要包工。本法適用一類工程，它是承包商自己能一手包辦的。例如公路工程。

啟鎖包工。最適用於大規模和重型工業。例如化工工廠。本類工程大部份通常包含有專利製造過程和特別技術。又包含大部份製成的設備。它們可以在很短的時間內。例如兩年內製成。因此製造和人工成本都能相當確定地預估出來。請記住。包商如要保障自己。總要假設在最壞的情況，而且無論最壞情況發生與否，業主都得付款。

啟鎖包工最简单的形式為按作業規格招標，也就是說，簡單陳述出來：產品、產量和品質、開工日期。啟鎖包商可以自由擇定和投標：他所認為最合適的過程。並且根據它來設計製造工廠。最適合的材料和修建法。

啟鎖包商只要報一個全工程總價。而且他可以接受逾期完工和工程缺點的罰款條件。

就一宗總額啟鎖包工合約來講。一直到工程完成鎖匙正式交給最後業主之前。包商實質上是臨時物主。唯一的分別工程完成開工以後。他不會長久與該工廠廝守在一起。至多幾

goes into production. Thus he might not be interested to the same extent as the final owner in operating efficiency and longevity. Realizing this, the final owner may amplify the simple statement of his requirements and go to some length in specifying what he wants. This brings endless variation to the simplest form of turnkey package.

Variations occur also in commercial terms, including those of terms of payment (only a portion may be fixed price), etc.

IV. What Does it Take to be a Project Manager, a Prime Contractor, a Turnkey Contractor?

Project Manager

To be a project manager one must have a management team experienced in managing engineering, procurement and construction (and some times also financing). One should also have the capability to undertake, with one's own forces, many of the activities being managed so that, if any contractor shows indications of failing and thus jeopardizing the project, the project manager can step in and take over.

Thorough understanding of all functions being managed is, of course, a necessity. Capabilities required for risk taking are slightly greater than for traditional consulting engineering assignments but the project manager remains the agent of the owner. He gets a professional fee above his actual costs. Usually, this is a fixed fee so that he is not subject to a negative incentive and has no interests of his own to contend with that would divert him from doing the best possible job for the owner.

The main characteristics of a project management organisation is a thorough planning approach to the entire project.

個星期或幾個月而已。因此他不曾像最後業主
· 對於作業效率和工廠壽命那樣注意了。我們
可以設想得到最後業主在開列需要規格時，可
能把一宗簡單的陳述引伸得長一矣。因此最簡
單的啟銷包工也就隨着變化無窮了。

商務條件上也有變化，例如付款條件等。

工程管理主任，主要包商和啟銷包商各應
具備那些條件？

工程管理主任，他應該擁有一批管理人材
· 他們長於管理工程、採購、和營造（有時也包
含財務）。他自己應擁有勞動力以備万一包商出
了差錯而致停工時，他馬上可以補充上去，繼
續工作。

當然，他對於其管理的業務必須一一了然
· 而傳統包工方法比較起來，本法所擔負的“風
險”畧微大一矣。但是工程管理主任始終是業主
的代理者，除開實際開銷以外，他也獲得職業
酬金，因此賄蝕也不會牽累到他。他自己并没
有好處要去汲汲經營，所以他可以安心為僱主
好好地幹。

本法的主要特真是將全盤工程加以徹底的
計劃。

Prime Contractor

A prime contractor must also have a comprehensive management team. In addition he must have personnel to carry out the construction, equipment necessary for the construction and financial resources to carry him through until payments meet costs and to absorb any losses that he may incur on the contract.

The main characteristics of a prime contractor are experience and capability in carrying out work involved in the project and ability to evaluate and take the risks placed upon him by the contract.

Turnkey Contractor

A turnkey contractor must have the combined capabilities of a project manager and a prime contractor, plus the financial resources to carry the bidding costs, which on a firm lump sum project can run to 1 per cent to 2 per cent of capital cost, i.e. on a \$100 million project bidding costs would run to \$1 to \$2 million. He must also either possess or have access to proprietary and other process know-how as may be required for bidding, designing and constructing the project.

PART B

PROJECT MANAGEMENT

Project management has been evolved, particularly in the last 15 years, to overcome the major weaknesses of the alternative means of managing projects. Essentially, the manager is appointed as soon as the project has been conceived and evaluated. His first duty is to confirm the cost of the project and to recommend the schedule of its development. Thereafter, he can assist the owner in the establishment of the financing of the project, or he can even undertake organisation of this on behalf of the owner. Upon commitment to

主要包商，他必須擁有一批綜合性的管理人材。除此以外，他還必須有施工人員、施工設備、財務力量墊付開銷。万一賠本，他可以負擔損失。

主要包商的特性是具有施工的經驗和能力，和能夠評估和承擔工程風險。

啟銷包商，本業者應當具有上面兩種包商的綜合能力和足夠財務力量應付投價開銷。該數值約為總成本的1-2%。

例如：一億元的工程，投標開銷約為1-2百萬元，他必須擁有或者有辦法知道專利的製造過程或其他特別技術，它們是為報價、設計或修建本工程所必須的。

乙 部

工程管理

本法是最近十五年才演進出來的，目的在於克服其他管理方法的主要缺點。一當某宗工程概念形成和價值評定以後，馬上委任一個工程主任，他第一樁責任便是覆証工程的總成本，並且建議施工程序表，以後他可以協助業主建立工程財務，或者他是自代表業主，主持工

proceed with the project, he is responsible for the control of detailed engineering, establishment of the contract packages for procurement and for management and supervision of the construction and assurance of quality. He makes provision also for escalation, contingency and insurance. In all these matters he acts on behalf of the owner.

Benefits of Project Management

The benefits may best be seen against the weaknesses of the alternatives. In traditional practice, detailed construction planning is frequently done too late and in insufficient detail and the construction viewpoint is probably inadequately introduced in the design progression. The constructed cost is not always appropriately factored into the design. The designers may seek quality and a degree of safety beyond the real requirements of value. Once designs are completed, it is difficult to make savings.

In turnkey practice, the contractor's aim is the maximization of his own profit and the owner has, in fact, reduced his responsibility and authority and thus ability to make interim decisions. As previously stated, the resultant quality of the completed project is not necessarily optimal in terms of operation and maintenance costs.

In the single contract approach, there are indeterminant risks

程。一旦受任管理工程以後，他便負責控制工程細節，把全部工程分成許多單位，以便分開招標，和管理監督工程，藉此獲得品質保證。他也作好準備，以備工作提前，雜項開支，和保險。在所有這些事務方面，他是直接代表業主。

工程管理的優處：

對照其他辦法的缺點，那麼本法的優處便顯而易見了。傳統包工裏面，詳細修建計劃往往訂得太遠，而且不夠明細。也許沒有在設計的过程中，適當地引入施工的觀點。修建成本也不是時時分析出來了。適當地列入設計裏面，設計者也許在摸索高的品質或者逾格的安全後，超過實際需要的價值。一旦設計完成以後，再要想節省一點，可就難了。

至於啟銷包工辦法，商人的目標是獲得最多的利益。於是事實上業主的責任和主權就隨之縮減，因而在工程進行中幾乎難於置喙。又如文所說，完工，工程的品質以作業狀況和保養成本來衡量。

單一包工辦法易有許多未定的“風險”，伏下

which become fodder for costly claims.

Project management adopts as its philosophy the control of risk in cost, schedule and ultimate operating performance. It does not necessarily seek to achieve the development of the project at minimum cost, but rather to ensure that decisions are made within an overall cost framework.

Planning is done in detail from the end of the concept stage, and strong budgetary, quality and schedule controls are established. These become firm before the project is committed to the major costs of detailed design, procurement and construction. Throughout the development period, the owner has continuous access to information and involvement in approval. His decisions, of course, must be within the framework of costs, quality and schedule established for the project. The schedule, in fact, includes distinct periods of time in which he makes individual decisions. Where owners' organizations are often complex, the discipline of timed decisions often tends to simplify the owner's own operations.

The formation of a proper plan, schedule and budget before major cost commitment is, in any case, conducive to good financing and insurance terms and allows a detailed financial plan to be made. Fund allocation can then become quite precise.

By deliberately keeping responsibility for, and control of, risk in his own grasp, the owner does not pay for risk taking by others and does not over-invest in risk protection.

The objectives of the manager are entirely those of the owner. It is up to the manager to bring to bear on any given problem

日後重大爭議的危機。

就哲學背景來說，工程管理採取了控制成本的風險，控制進度和最終作業之況，它並不一定要最低的成本，而無寧是要求在全盤成本預算之下，各樣決定都作適當。

工程概念形成以後，開始策定詳細計劃，隨後定下嚴格的預算，品質控制規格和進度控制計劃，這些是不可以變動，然後全工程分開來交付詳細設計，採購和修建，全部發展過程之中，業主不斷收到報告，掌握著工程，當然，他的決定必須在已經確定了的成本，品質，和進度的範圍之內，事實上，進度表明顯地劃分出來許多階要，在各階要之內，他作著單獨的決定，業主的機構通常組織很複雜，上述分期作決定的原則有助於簡化業主的作業。

上面所講的先制定適當的計劃，進度，和預算，然後再動支主要成本款項，這項辦法對於建立良好的財務和保險條件，極有益處，俾詳細的財務計劃得以建立，款項的分配也頗為準確了。

業主自己有意也負担起「風險」并且加以掌握，他就可以免掉付款給人，讓別人承當風險。

all the skills and experience necessary to solve the problem in an economic way. It is, in fact, his duty to do so before the problem develops.

Finally, the owner retains control through the manager throughout the development of the project.

Project Management - Objectives

In simple terms, the primary and vital objective of project management are to complete the project within the scheduled time and for the predetermined budget cost.

Other objectives may also be set but these will require to be put in non-conflicting order and they will be secondary in importance.

Project Management - Basic Techniques

When the objectives have been established and adopted, a master plan is developed to reach the objectives. The master plan must include all significant operations, allow appropriate times for all activities and approvals and establish work packages in competitive and controllable units. Real control is based upon the early removal of risk, in terms of both time and cost and the deliberate maintenance of freedom of choice within the plan.

As discussed above, the essential difference between the project management concept and other styles of management is that planning is done early and thoroughly and is controlled exclusively to the interest of the owner. In no

因此在“風險”保障方面，不致於超額投資。工程
管理主任和業主的目标是一致的。至於应用技术
和經驗去經濟地解決一個問題，則是主任的
權責。

最後，業主通過主任從頭到尾，掌握著全
盤工程。

工程管理——目标

簡單來說，工程管理的首要目标，就是要
在預定的進度表和預算之內，完成一宗工程。

我們也可以訂下其他目标等，但安排的次
序不可有衝突，而且性質上也是次要的。

工程管理——基本技術

為了目标建立了并經採用以後，先訂下一
個總計劃來達成這個目标。總計劃必須包含所
有重要的施工作業，並且有適當的時間處理和
批准。工作又要分成單位，着眼在便於控制和
比價。算正奠基於防患於未然（着眼在時間和成
本）和有意地在計劃中留有餘裕。

上面已經講過了，工程管理的觀念和其他方
式的管理根本差異的地方，是前者預先計劃徹
底地，而且特別顧到業主的利益而掌握工程的

case are foreseen problems left for later resolution or for resolution by others. Within the overall plan, there is freedom to change but change is only made from an adopted solution to an alternative solution if there is a clear benefit.

Method of Contracting

In formulating the master plan, the work is broken down into elements, or packages, which are normal to the practice of the various industries, notably the contracting industries. The packages are planned to be free from interface problems such as potential interference in other operations, or impeded access, and they are arranged in terms of capital worth to provide good competition in bidding on a national or international basis. It is possible, as part of cost control technique, to provide packages which are composed of smaller elements that can be bid in total by large contractors while, at the same time, smaller elements are being bid by smaller contractors. This tends to keep prices of large contractors near the lower overhead price levels of small contractors. Other techniques, such as the introduction of pilot contracts, can be adopted to establish deliberately the price levels for work of a particular character.

In the establishment of packages for international work, particular attention should be given to making optimum use of financing sources for both construction and procurement

無論任何情形之下，凡是目前能預見的問題，絕不拖到日後去工作決定，或者讓別人會作決定，在全盤計劃之內也留得有更多的餘地，但更改限於有確實利益的時候，才可以由批准的方法改為另一方法。

訂合約的方法

訂實總計劃時，把工作分為許多單元或單位，它們是與各行業的業務相符合的（特別是承包業），各單位之間避免發生干涉問題，例如可能牽制，到別的单位或前者未完，後者不能動工等，單位是按照成本值來劃分的，以便在國內或國際間招標時，利於競價，作為成本控制技術的一部分，可以將各單位再細分為許多小單位，便於總包商投標，它再分標給小包商，這種方法似乎可以把總包商的攤費降到各小包商較低的攤費水平，其他的技術，例如引入主導合約等也可以採用來有計劃地建立某特別性質工作的標價水平。

對於國際性的工作，劃分工作單位時，特別要注意有利地利用貨幣金融關係，招標修建和採購工程，通常避免固定使用一種貨幣，可

contracts. It is often desirable to avoid the risk of being tied to one particular currency where fluctuation would be to the serious disadvantage of the project.

Having too few contracts often tends to diminish the amount of competition and to exclude real participation by local contractors. A balance should be maintained in the sizes of the various contract packages to retain an adequate amount of competition without creating too many potential interface risks.

Generally, having contracts of relatively short duration permits the continuous assessment of market conditions and appropriate adjustment within the master plan to achieve the best results.

Project Manager's Role and Functions

As previously stated, the project manager's objectives are identical to those of the owner and, indeed, he acts exclusively on the owner's behalf.

His role is distinct from that of a consulting engineer and his overriding responsibility is to develop and accomplish the project plan within time and at budgeted cost. Generally, the manager retains the services of consulting engineers to secure good design on behalf of the owner, and he should not impose conditions which do not permit a consulting engineer to fulfill his obligations as to safety and performance. On

—該貨幣發生波動·對於工程會有不利的影響。

如果合約數太少·那麼常常趨向於減少競價的量·和排斥本地的包商使他們不能參加競標·因此各工作單位的量應盡量劃分得平均·以保持適當的競價量而不致於發生太多互相牽制的问题。

一般來說·各項合約的施工期·如果相對地短暫·那就便於不斷地推測市場行情·隨之在總計劃範圍之內·作適當的調整·以便獲得最好的成果。

工程管理主任的身份和職責

前面已經說過·工程管理主任的目標是和業主的是完全相同的·他確是代表業主主持工程。

他的身分和顧問工程師是迥然不同的·他的全部責任便是要在預定時間和固定預算之內·完成工程·一般來說·主任代表所有人聘請顧問工程師訂立良好的設計·他不應當掣肘工程師使後來不能在安全和工程性能方面盡到他的責任·但是在另一方面·安全和性能的標準

the other hand, these criteria must be achieved within the framework of time and costs to completion. It is also usual to report the status of commitment. Adverse trends are highlighted to permit early corrective action. Cost forecasting includes monitoring of engineering concepts and designs in the development stage and extrapolation of construction costs based upon these concepts and designs.

The project manager will carefully analyse all requests for changes in scope within the project in consultation with the owner and, upon receiving the owner's approval will make appropriate modifications to all areas affected. Generally, only those changes in scope which are directly beneficial to the owner are adopted.

Elements to be Managed

Irrespective of management organization adopted, the elements to be managed are: Engineering, Cost Estimating, Financing, Procurement, Construction, Setting up Operations, Commissioning.

Engineering:

Under project management, engineering remains one of the primary elements to be managed. Its most important roles are in concept and design and in the exercise of responsibility in matters of public safety, selection of materials, and operational needs.

也要在預算和完工日期的範圍之內完成。通常主任要時常報告施工現況。不利的形勢要強調提出。以便及早糾正。主任所提出成本預報應當包含：在發展初期監督工程觀念和設計的成本和根據它們而延加的修建成本。

對於更改工程的要求，主任應當小心地加以分析。不可以超出工程範圍之外。並且向業主洽商。得到業主批准以後。他然後把牽涉的方面。作適當的修改。

一般來說。只有直接有利於業主的更改意見才可以採納。

所管理的工作

不論採取那種管理組織。應當管理的工作如下：工程。成本估價。財務。採購。修建。開工作業。正式服勤等。

工程

在工程管理法之下。工程一直是要管理的重要項目之一。工程在下列業務方面扮演著最重要的腳色。觀念孕育和設計。執行有關公共安全事務方面的責任。選擇材料。決定施工需

In the development of concept, the engineer must consider the objectives and requirements of the owner and, having reviewed the topography, geology and available resources at site, prepare a physical layout which will establish major dimensions, types of equipment and operating characteristics. This layout is optimized according to the cost and value information available to the engineer.

The project general manager and other managers review the concept developed by the engineer and develop the master plan and final budget.

Upon approval of the master plan and budget, design engineering can proceed. This phase of work includes the preparation of the detailed designs, technical specifications and drawings required for ordering equipment and materials and for the award of construction contracts. It is important that the work is organized in direct relation to the finite contract packages which form the elements of the master plan, i.e. control of schedule and cost are done throughout on a contract package basis.

It is a sound philosophy to provide the contractor with the maximum amount of information possible, so that he may price work fairly.

For all packages, a detailed construction method and schedule are pre-determined. The contractor may however propose an alternative, provided he can show that his solution is of benefit to the owner. The engineer must be able to respond to obtain the benefit on the owner's behalf.

在開展工程概念的階段，工程師必須考慮到業主的目的和要​​求，然後檢討地形、地質和土地所有的資源，繪出概要圖，表明主要量度、設備種類和操作特點。本設計又根據成本和價值加以增訂，要求達到最有利的地步。

工程管理主任和其他管理員們檢討工程師所提出的概念，然後製成總計劃和最後預算。

總計劃和預算核准之後，設計工程就可以着手了。本階段包含以下工作：完成詳細設計，技術規格和繪圖供採購設備材料和訂約之用。最重要是各項工作的劃分和組織，要求與一定數目的招標工作單元直接有關係。這些工作單元（或稱工作單位）即構成總計劃的元素。也就是說，進度和成本的控制，自始至終都是以工作單位為準的。

所以供給投標商全部的資料，希望他投價合理，是合於情理的事。

各項工作單元，都預先訂出詳細的施工方案和進度表。但是投標商也可以提出別的方法，只要他能證明他的方法對於業主有利，工程師必須能夠代表所有人擇善而從。

Cost Estimating, Budgeting
and Forecasting:

Recognizing that the engineer is primarily a creator of concepts and designs and that he can have a strong proprietary interest in his design, it is essential that his work be reviewed by people skilled in cost estimating and construction technology.

Under project management procedure, cost estimating is first used to establish the budget. Thereafter, at various stages during development of designs and prior to calling for construction and supply bids, further estimating is undertaken by the estimating group which reports directly to the general manager. The group consists of engineers and technicians who are highly experienced in construction planning and in construction and have specialized in cost estimating. They look upon the facility to be constructed in the same way that a contractor would in evaluating a job and they use similar thorough estimating procedures.

The work of the estimating group is also used during the various stages of design development to guide the designers and thus achieve for the owner an economical and controlled solution.

Cost forecasting is also used during the construction stage to predict trouble spots and to permit action to be taken to avoid overrun in cost.

Finance:

The financial elements to be managed are as follows:

- Review of overall financing requirements.

成本估計，訂預算和成本預報

我們要承認工程師是觀念和設計的創造者，而且在他的設計裏面，可能具有強烈的專利利益。因此他的工作得交給擅長於成本估計和建築技術的人去檢討。

在工程管理法裏，成本估計首先用來建立預，以後在設計進展的多個階段中，和招商投標（修建和補給）之前，估價組再作進一步的估價。本組直接向總經理負責。本組包含有許多工程師和技術人員，他們對於修建技術和計劃具有豐富的經驗，並且專長於成本估價。他們評價一件工作所取的看法和包商一樣，而且所採取估價的步驟也與包商相同。

在設計進展的每一個階段中，估價組的工作也用來引導設計者，而為所有人完成一件經濟的、有計劃的方案。

至於在各修建的階段裏，成本預報也用於預測困難，以便採取行動，防止超支預算。

財務

應管理的財務項目如下

——檢討全盤財務要求

- Preparation of a financial plan, taking into consideration time phasing of expenditures and cost of raising and servicing funds to be borrowed to meet these expenditures.
- Optimization of the financial plan, with respect to both costs and risks, and the integration of the financial plan into the project master plan.
- Prenegotiation of terms of export financing with export credit authorities and other tied financing.
- Continuing review of currency risk situations.
- Establishment of insurance policies for the project.
- Participation in review of bids and especially of the financial terms and conditions included therein.
- Establishment of the operating cost budget.
- Establishment and administration of the accounting systems for the project, including organization of auditing.
- Establishment of the management information system covering all financial matters relating to the project.
- Monitoring of all costs.

Procurement:

Procurement consists of the purchase, checking of quality and acceptance of equipment and supplies required for the project. It includes the solicitation of bids, the evaluation thereof, the negotiation and award of contracts, the inspection, expediting and acceptance of the items purchased and the payment therefor.

Procurement and finance are closely linked and constant

- 製備財務計劃，考慮到分期開銷計劃和為支付開銷而借款所產生的手續費。
- 選擇最有利的方案平衡成本和風險。
- 預先向外銷信用單位和其他有關單位洽商外銷財務條件。
- 繼續檢討貨幣波動情形。
- 工程保險
- 參加檢討標價（特別關於它的財務條款和條件。
- 建立經常費預算
- 建立和管理會計系統，包含組織審核單位。
- 建立管理查詢系統，處理有關本工程之財務事宜。
- 監察所有成本。

採購作業

採購作業包含購買，檢查品質，接收設備和補給品等。本作業包括招標，評標，議價和定標，和檢驗，催貨和接受物料和付款等。

因為採購和財務業務關係密切，所以工

attention is required by the project manager to ensure that the full benefits of export credit and other special finance arrangements are achieved.

Under project management procedures, contract packages are scoped (arranged) to make each package appropriate for the specific abilities of the various entities accepted as potential bidders. Scoping of contract packages is designed to obtain the best prices and terms for world-wide tendering. If desired, specific portions of work can be established for award to local contractors. During project execution, such contractors can be encouraged to increase their capabilities.

Contract packages are also designed to eliminate or reduce potential interface problems between contractors, to minimize interface claims and to prevent overruns.

Construction:

As an element to be managed, construction falls into two important phases: construction planning and construction implementation and control.

Under project management, the construction planning is given careful attention before the award of each construction contract and, in fact, much of this work is done before finalization of the project master plan. As described above, the work of the estimating group continues through the engineering design phase and the designs are continuously monitored from a construction and cost viewpoint. This work can be described as value engineering and is designed to produce benefits in good construction methods, removal of areas of potential delay and assured completion dates to provide assured revenue.

程管理主任必須經常注意，要求外銷信用的優待條件和其他特別財務商定辦法都利用到了。

在工程管理程序之下，要求投標工程單位劃分適當類形各專業商的行業，便於招徠國際性承包商，而獲得最有利的標價。如果有需要，工程的某一特別部份可以撥開來交本地商人承包。施工期中，上述的本地商人可以鼓勵他們多包工程。

劃分上述工作單位時，避免各單位間之相牽制影響，以減少爭議和防止超支預算。

修建

本業務分為兩期，即計劃與施工和控制兩期。在工程管理法之下，每件工程未交承包商之前，先加以仔細地考慮。事實上在總計劃未策定以前，大部份的計劃工作就已經做完了。如上所述，估價組在全工程設計階段就一直繼續工作，並且不斷地從施工和成本觀察來監察工程。這項工作可以稱為評價工程。它的应用如下：应用良好修建方法獲利，移去可能誤期的因素，確保延期完工（保障收益）。

每一件工程的詳細計劃和方法仍然交給承

Detailed planning and methodology within each contract are still left to the contractor and, as stated above, a contractor can propose alternatives at the time of bidding provided he can show that they are of benefit to the owner. In all cases, a contractor is required to produce his final methods and schedule of construction within a limited time after the statement of intent to award contract.

During the construction implementation stage, the work of the contractors is stringently monitored to ensure their adherence to schedule and quality standards. The role of the project manager in the construction pahse is to require the contractors to meet their schedules and the standards of quality established for the project.

Assistance in Setting Up Operating Groups:

In cases where the owner does not have previous experience in operating particular facilities, the project manager can undertake to set up or assist in setting up an operating department.

Operating requirements are intimately involved with the design of the various systems. It is beneficial, therefore, to recruit operating personnel early so that they may be involved in the work of the engineers.

Thereafter, operating staff should be involved in the establishment of commissioning procedures so that they are ready to play their role on behalf of the owner in acceptance of commissioned work.

Commissioning:

Commissioning consists primarily of putting into operation the equipment and facilities. It involves performing final inspection, testing and acceptance, in an operating condition,

色商人去辦理。而且，如上所述，商人在投標時仍然可以提出其他的方法，只要他能證明新法對於業主有利的話。在所有情形之下，某承包商得標以後，我們就要求他提出最後的施工方案和限期完工進度表。

在施工階段承包商的工要加以嚴格的監察，要求符合進度表和品質標準。這是工程管理主任的責任。

協助籌設開工組

如果所有人對於操作某種設備沒有經驗，管理主任可以負責或協助設立開工組。

開工組要求的事項與各種系統的設計有密切的關係。因此早期招聘初期開工操作人員，使他們參加工程工作，是有利的。

然後使開工人員參加訂立程序，日後他們就可以代表所有人員負起開工的任務。

設備服勤

本步驟包含使機器和設備運轉，它包含實施最後檢驗，試車和接收承包商的完成待用的設備和建築。

of the equipment, construction and, facilities provided by the contractors. Contractors, subcontractors, design engineers, procurement managers, construction managers and the owner's operating department all have responsibilities and roles in the various commissioning tasks.

The co-ordination of commissioning is the responsibility of the project manager and he must have in readiness detailed procedures for the commissioning of every element and system in the project. On major projects, the preparation of the commissioning procedures will require many months of work.

It should be noted, however, that the project manager is not required to operate the project unless his contract, price and insurance coverage are specifically designed to cover this role.

Organization:

The general organization of the project manager's work is conveniently shown in the attached two charts. The charts are arranged to show the roles of the various managers within the project management organization and the phasing of the work as it proceeds through planning, design, procurement and construction.

The chart also shows the flow of data and highlights the techniques of control. The two documents, in fact, indicate well the degree of organization which is essential to good management.

承包商·次承包商·設計工程師採購主任·
修建主任和所有人的開工組，在使設備服勤的
任務中各負有不同的任務和責任。

但協調服勤業務則是工程管理主任的責任
，所以他必須準備好工程的每一單位和系統的
服勤操作的詳細步驟，在主要工程裏，製訂服
勤程序往往是幾個月的工作。

但是應當注意的，管理主任並沒有責任去
開工操作所完成的工程，除非他的契約和保險
金額都特別訂明要負責。

組織

工程管理主任工作的一般組織見於附表1.2
。本表顯示組織裏負責人的任務及工作時期的
劃分(計劃·設計·採購和修建)。

GOVERNMENT AND THE CONSULTING ENGINEER

by

J.B. Motta

- Government at all levels is a major user of consulting engineers
- Use of Canadian engineers internationally - CIDA and EDC

政府与工程顾问

(莫泰)

——各等政府都利用工程顾问

——加拿大工程师为国际利用

GOVERNMENT AND THE CONSULTING ENGINEER

In Canada we have three levels of government - federal, provincial and municipal.* Each of these has its own defined and separate responsibilities and interests. This separation of interest prevails on engineering projects each undertakes. For example, the federal government activities encompass such areas as air and sea transportation, northern development, postal services, international development, national parks, etc., with the result that they sponsor projects* such as airports, docks, government buildings, etc., and, in federally controlled land, highways, bridges, etc. In turn, provincial governments are responsible for projects* such as universities, electric power projects, provincial highways, etc., which fall into their domain. Municipal or city governments are involved with* water supply, water and sewage treatment, primary and secondary schools, urban development, electric power distribution, etc.

It is obvious, then, that the different levels of government in Canada are sponsors of a large number of diverse engineering projects. While governments are major employers of engineers who are involved in the planning and implementation of these projects, they are also major users of private engineering consultants. In fact, it is estimated that approximately 70 per cent of project engineering undertaking by Canadian governments is subcontracted to private engineering consultants and architects. In turn, the different levels of government as clients represent approximately 40 per cent of the business obtained by the Canadian consulting engineering industry - a significant percentage.

政府与工程顾问 (莫泰)

在加拿大，我们有三等政府，中央政府、省政府、和地方政府。各政府本身有明确和不同的责任和利益。这种分立的責任，均見於各自承担的工程計劃上。比方，中央政府活動的範圍包括航空和海洋的運輸，北部的建設，郵政，國際間的發展和國家公園等。所以中央政府就負責机场、碼頭、政府大廈的建設，和中央政府屬下的土地、公路、橋樑的建設計劃。跟著省政府則負責大學、電力發展和省內公路的工程計劃。反之地方或城市政府則負責水源供應、用水和污水的管理、小學和中學、市區發展和電力分配等。

很明顯地，加拿大不同階層政府是很多不同計劃的策劃人，工程師負責各種工程計劃的設計和建造，而政府則是工程師們最大的僱主。這樣使到私家工程顧問很有地方利用的機會。事實上，估計有百分之七十由加拿大政府負責的工程計劃都轉由私家工程顧問和建築師包工完成的。各級政府是加拿大工程顧問行業的主顧，約有百分之四十的業務都是取自政府的——一個重要的比率。

Perhaps we can review how consulting engineering services are utilized by the Canadian government. Normally, we let contracts for either studies (feasibility or surveys),* design or engineering, project management and a combination of any or all of these.

1. Studies. The following are examples of the wide diversity of studies undertaken by consulting engineers on behalf of the federal government:

- To assist in the development of government policy in the communications sector. Ten studies were commissioned to determine the needs of Canada in the area of data communications. Such questions as to size of market (need), industrial capability, product development requirements, international developments, etc., were investigated in detail. In this case, the consultants obtained the detailed information which will enable our Department of Communications to come up with appropriate policies and programs.
- Another example of studies in the communications sector is an engineering consultant looking into the feasibility of building future communication satellites in Canada*, e.g. the economics, the technology, the manufacturing, capability, etc.
- In transportation, many studies are always underway on such diverse topics as evaluating lighter than air ships for transporting oil from the Arctic or evaluating the optimum method of powering* ice breakers (steam, gas turbine, nuclear, etc.).
- Survey studies constitute another role consultants undertake on our behalf.

或許我們可以察看加拿大政府如何利用工程顧問的服務，通常政府交給他們的合約是工程的研究和設計（可能性或調查）計劃的管理，或以上所有部份的組合

(一)初步研究：以下是工程顧問代表中央政府處理的各種不同研究，例如：

——協助政府在傳達發展方面的政策，進行十種不同的研究去決定加拿大在資料傳達方面的需要，各種問題如市場的大小，工業的發展，產品的改良和需要，國際發展等，都做詳細的調查，這樣顧問就要取得詳盡的資料，務使傳達的部門獲得適當的政策和打算。

——工程顧問研究傳達方面的另一例子是看看將來在加拿大建立衛星傳播系統的可能性，即指在經濟技術、製作和能力等方面而言。

——運輸方面，進行多項的研究去尋求輕量的運輸法把原油從北極運輸，或去衡量以更大能量加強破冰船運輸的有效方法。（用蒸氣、蒸氣渦輪、原子能等）

——工程顧問另一角色是為我們進行調查的研

They include, for example, a census of fish on the Scotian shelf using advanced technology scanning equipment, or providing an inventory of Canadian* glaciers.

- In the environmental sector consultants are surveying levels of pollution in our* streams and rivers.
- One of the energy studies the Canadian government has commissioned is the feasibility of Canada undertaking a development program for fusion energy.

2. Design. Design projects commissioned by the Canadian government are many and varied. For example, on federal buildings like our Department of External Affairs building*, the National Arts Centre*, post offices, airports*, radio-television studios*, penitentiaries, etc., consulting engineers work with architects on such problems as acoustical engineering, foundations, heating, ventilating and air conditioning, illumination and lighting, structural engineering, electrical and communications engineering, concrete technology, etc. Their specific responsibilities in these areas are normally given as subcontracts. While this represents the largest volume of design work undertaken by engineering consultants, there are other highly specialized needs. For example, a contract has been let to an engineering consultant to design a Canadian-French telescope which

究。

例如：利用高級的掃描儀器去探查蘇格蘭暗礁真類的分佈情況，或供給加拿大冰山的所在。

——在自然環境方面，顧問們則去調查河溪的污染程度。

在加拿大政府進行的能量研究裡，其中一項是看看加拿大是否能夠從事綜合能量的發展。

(二)設計：加拿大政府從事的設計計劃很多而且不同。

例如：中央政府的大廈如外交部大樓，國家藝術中心，郵局，機場，電視，電台工作室，自新監獄等。

工程顧問與建築師一起工作，處理的問題包括聲學上的工程，基礎工程，暖氣，空氣的流通和調節，光暗和燈光，結構工程電力和交通工程，三合土技術等，他們在這些範圍的個別責任通常都以轉包方式完成，而這種方式是工程顧問從事設計工作的最大比率，如有其他專門的要求，例如：

will be placed on top of a 14,000-foot mountain in Hawaii; in this case a unique dome is required. In another case, an experimental stable* platform is to be designed for construction "offshore" in the Atlantic Ocean. A development contract was let to develop a method to cut paper using laser beams. This was required because conventional cutting tools were not suitable on the new high speed paper mills. Another example of a civil engineering project is in our national capital, Ottawa, where the Department of Public Works commissioned consulting engineer to design the MacDonald Cartier bridge.*

3. Project Management. Canadian engineering consultants can and do undertake projects in which they are required to carry out complete design and project management. Examples of the types of projects they could undertake under federal auspices are the McKenzie Highway** through Canada's Arctic or a huge oil unloading dock at Come-by-Chance, Newfoundland**.

As mentioned earlier, other levels of government implement projects which normally require the services of consulting engineers. In Canada each of the provinces manages its own power utilities and is responsible for power generation, transmission and distribution. These organizations use consultants extensively on dam design, foundations, tunnels, soil studies, environmental studies, systems design, etc. Other areas involving consulting engineers include pollution abatement, higher education (colleges and universities), roads and highways, forest

一個工程顧問接到一張合約去設計一座加拿大—法國的望遠鏡，是要建在夏威夷一個一萬四千呎的高山上的，所以先要建一個巨大的圓頂建築物，另一例子是在大西洋海中設計一座實驗台，或去從事發展一種超級的電光鎗去切割紙張，因為普通的切割工具在高速的造紙廠極不適宜，另一土木工程的例子是工務局在首都渥太華從事麥當奴吉地大橋的設計。

(三)計劃管理：加拿大的工程顧問能夠從事一件工程的整個設計和管理，這類計劃如貫通加拿大北極的麥堅時高速公路，和在紐芬蘭今新的龐大汽油船塢，都是由政府贊助的。

正如先前所述省政府和地方政府所完成的計劃通常都需要顧問工程的幫助，在加拿大每省都處理自己的電力公用事業並負責發電，輸送和分配的工作，這些機構都常請工程顧問去設計水壩，地基和通道，土壤和自然環境的研究，系統設計等，其他方面，如減輕污染程度，高等教育（學院和大學），道路和高速公路

management and natural resource management. In turn, municipal governments use consultants to design capital projects such as water and sewage treatment plants, bridges, buildings, etc., and to carry out studies on such matters as traffic flow, urban development plans, surveying and mapping, noise control, flood control, building services, etc.

Canada, like China, makes efforts to assist the world's developing countries. The arm of the Canadian government responsible for administering our assistance programs is the Canadian International Development Agency (CIDA). Most of the funds set aside for development assistance are used for bilateral (country-to-country) programs, made up of projects requested by developing countries and agreed to by Canada. Some 1,600 students and trainees from more than 60 countries were in Canada at the beginning of 1973 for advanced studies. Meanwhile, 974 Canadians were serving overseas, carrying out hundreds of development projects. This wide ranging program of technical assistance was supported by food aid which was used to send shipments of wheat, flour and other foodstuffs to countries suffering food deficits. However, the largest portion of Canada's development funds were allocated for other forms of economic assistance - the provision, for example, of commodities, fertilizers, aircraft, locomotives, schools, bridges and planning services. It is in this area that Canadian consulting engineers have made a great contribution. On behalf of CIDA they have been instrumental in planning, studying, designing and carrying

，森林和矿产的處理都与工程顧問有关，跟著
，地方政府則顧問工程顧問去設計巨大的工程
如濾水廠，污水处理，設備橋樑大厦的建造等
，同时去進行交通流動，市區發展計劃的研究
，測量和製圖雖声操縱，防洪和大厦的建造等

加拿大正如中國一樣，都尽力幫助世界上的
的開發國家，加拿大政府負責這個援助計劃的
部門是加拿大國際發展事務局(CIDA)，大部份
用作發展援助的基金都基於双務契約計劃(國
與國)，這些計劃是由開發國家提出而加拿大政
府同意的，一九七三年初，來自六十多個國家
的一千六百位學生和練習生在加拿大接收高等
的教育，同时九百七十四位加拿大人正在海外
進行百多個工作計劃，除了這個範圍廣泛的技
術援助外，還加上糧食援助，大麥，麵粉和其
他食品都由船隻載運支援糧食缺乏的國家，然
而加拿大絕大部份發展基金是在於其他經濟方
面的援助——供应用品，肥料，飛機，汽車，
學校，橋樑和設計的援助。就在這方面加拿大
的工程顧問作了很大的貢獻，他們代表加拿大
國際發展事務局(CIDA)在工程上的計劃，研究

out engineering works of all types. Their contribution has worked to the benefit of many lesser developed countries.

The Canadian development assistance program in South and South East Asia is CIDA's largest bilateral program. Examples of Canadian consulting engineering efforts in this area include:

(a) Pakistan

The electric power developments in Pakistan have extensively used Canadian technology. A milestone was reached in November 1972 with the inauguration of the Karachi Atomic Nuclear Power Plant*. Other power projects have included the Warsak Dam* which generates 240,000 kilowatts of electric power and irrigates 115,000 acres of land. Pakistan's first earth satellite station, designed and constructed with Canadian assistance, recently became operative.

(b) Indonesia

This year Canada's program in this country has focused on forestry and civil aviation sectors. The consulting engineering role includes a study of the pulp and paper industry as well as airport design and studies as to how to strengthen air links between its many islands. In addition, Canadians are providing feasibility and design engineering studies for a bridge reconstruction* in South Sulawesi province and the Lombok island water resources study.

(c) India

Again, Canadian expertise in electric power is being utilized. A Canadian consulting firm from

，設計作了很大的幫助。

加拿大在東南亞的發展援助，是加拿大國際發展事務局(CIDA)最大的計劃，加拿大工程顧問在這方面的工作包括：

(a) 巴基斯坦

巴基斯坦電力的發展，廣泛應用了加拿大的技術，自一九七三年十月喀拉奇原子能發電工廠開幕後，已進入一個新的里程碑。其他的發展，包括能產生二十四萬千瓦電力和灌溉十一萬五千畝土地的華丘水壩。第一個在巴基斯坦由加拿大援助建造的地土衛星站已開始啟用。

(b) 印尼

加拿大政府今年在這國家的計劃著重於森林和民航上。工程顧問的角色包括了研究紙漿和造紙工業和機場的設計，如何加強與其他島嶼的航空連繫。再者，他們並且提供在南峇厘維斯省與龍白島間重建橋樑的可能性和設計。

(c) 印度

加拿大再次使用在電力上的專長，一間滿地可工程顧問公司為印度設計了一座

Montreal designed Asia's highest arch dam.* Now nearing completion, the Idikki dam in Southern India is the largest of three in a hydro-electric project that will produce 780,000 kilowatts. Other power projects have included the Kindah* dam and the Trombay* nuclear power station. Other projects include telecommunications* and water resource studies.

(d) Malaysia

In Malaysia CIDA, with Canadian engineering consultants, contributed to a radio and television broadcast centre and an economic study connected with the Sabak* forest industry. Feasibility/design/project management of the Temengor hydro-electric power and irrigation project was another project.

In Africa and Latin America the situation is much the same. Telecommunications projects in Zaire and Tunisia; airport projects in Mali, Senegal and one under study in Congo - Brazzaville; road building projects in Niger and Zaire; mineral prospecting, irrigation and agriculture as well as studies on forestation, fishing in countries like Ghana, Upper Volta and Niger. One of the major projects on which negotiations began in 1972 is the construction of 12 concrete silos in Algeria. Canadian consulting engineers are providing the leadership and the Canadian government, through CIDA, is sponsoring them.

亞洲最高的拱壩。在南印度的意地其水壩是三者中最大的一個。已接近完成。這個水力發電的計劃能產生七十八萬千瓦電量。其他能量發展的計劃包括甘達和東便的核子發電站。還有電視傳真和水源開發等的計劃。

(d) 馬來西亞

加拿大國際事務發展局和工程顧問在馬來西亞方面造了一個電台和電視廣播中心。並且為山巴森林業工作了一個經濟研究。另一個計劃是在塔尼哥作水力發電和灌溉的研究。包括可能性。設計和管理的工作。

在非洲和南美洲的情況大概相同。例如在西亞和達尼西亞的電視傳真計劃。馬利。新尼哥。和在剛哥。有沙村的機場。在尼之和西亞的築路工程。礦產。灌溉。農業。森林業。展望和在加納北原他尼之和的漁業計劃等。其中一個主要的計劃。從一九七二年已經開始談判。是在亞爾及利亞建造十二個三合土地下室。由加拿大工程顧問作領導。加拿大政府藉加拿大國際事

Canada's efforts to help African nations solve water shortage problems increased last year. Canadian expertise will be used to build a new water supply system for Dar es Salaam, capital of Tanzania, and two rural water supply projects in Ghana and Kenya will be completed. Also, in Tanzania, Canadian engineers will design and construct new power transmission lines and do a large scale topographical survey in central, north and west Tanzania. Last year a major study for the redevelopment of Jamaica's two international airports and detailed designs for water supply systems at four Jamaican cities were completed.

I have reviewed types of projects consulting engineering firms undertake on behalf of governments. Included were projects consultants assist CIDA in carrying out in developing countries. Perhaps I should dwell briefly on certain other activities. In addition, to projects which come under the direct responsibility of governments, e.g. roads, power, government buildings, etc., we become involved in activities which might normally be left to private industry to develop. Examples in Canada include the development of nuclear electric power plants*, pipelines in the Arctic, pollution abatement techniques and so on. These types of projects may not have been developed in Canada because of high costs if governments did not fund them. Also, for certain types of technology and engineering development it is in the public interest that governments be responsible and hold the technology available for all of industry rather than have it in the hands of only one company which might exploit this knowledge to the detriment of the country.

務發展局資助進行。

加拿大政府幫助非洲國家解決水源缺乏的努力，自去年已開始增加。加拿大各方面的專長正好為突尼西亞首都達卡建造一個新的供水計劃。在加納和塞地的兩個供水計劃已接近完成，再者，加拿大工程師們將為他設計和建造新的電網和在中部北部和西部作一個廣泛的地形測量。去年一項研究在耶米加兩個國際機場的重建和其他四個城市供水計劃的詳細設計，已順利完成。

我已重述了工程顧問公司代表政府從事的各种工作，包括協助加拿大國際事務發展局在開發國家進行的計劃，或許我應簡略的談談其他的活動範圍。

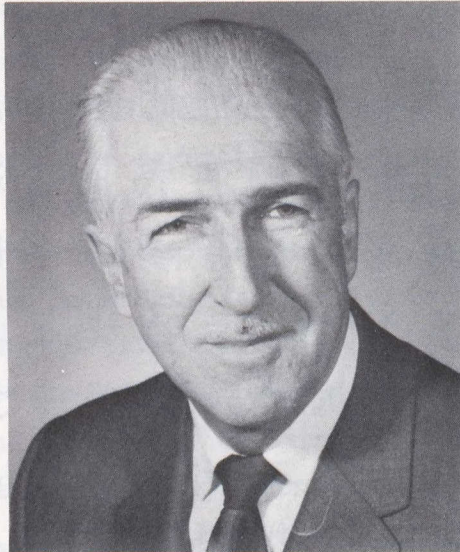
再者，由政府親自主持的計劃如道路、發電、政府大廈通常都交給私家公司去處理，在加拿大這種例子包括在北極進行的核子電力發展和運油管的裝設計劃、減輕污染計劃等。這種計劃費用很大，若沒有政府的資助，實難在加拿大建立。有些技術的發展和工程的建造，政府都以公眾的利益為主，同時使到這種技術都能普遍用在每類工業上。

As a result, governments use the services of consulting engineers to develop technology on governments' behalf. In turn, governments find means of transferring the acquired knowledge to appropriate industrial organizations. There are many examples of this in fields of energy, mineral smelting, mining and transportation. A specific project now underway is one in which we commissioned a consultant to develop a method of transporting coal as a slurry in a pipeline and find a means of later separating it from the liquid medium. The engineering consultant is also a means of taking technology out of government research establishments and finding practical applications for this technology. The results are retained by government for licensing back to industry.

I have tried to demonstrate the wide spectrum of work Canadian engineering consultants carry out on behalf of the three levels of government in Canada. However, I should point out that governments in Canada do have large engineering organizations - departments of public works, departments of highways, city engineering departments, departments of national research, all have engineers involved in design, study and construction. However, they recognize that there are conditions such as time or special needs that require the services of a consulting engineer, for there is no organization with staff sufficiently qualified to find the best solutions to all problems on a flexible basis. You have heard the many advantages of using consulting engineers and I can assure you that the Canadian Governments find it to their advantage - as I have tried to demonstrate to you today. Certainly we recognize that this industry is making a major contribution to Canada's development.

防止一個公司操縱這種技術，損害國家的利益。所以政府利用工程顧問的幫助為國家發展工作。跟著政府運用適當的方法把需用的技術智識分發到適當的工業團體。如在能量冶礦、開礦和運輸方面等。一項現在正進行的特別計劃是我們要求一個顧問公司去發展一種方法，把煤以混合液體方式用鋼管運送。然後把它從液體裡分出來，工程顧問亦可以說是把技術從政府研究成就中取出來，再加以實用，其結果是政府再以發行執照方式用在工業上。

我曾尽力說明加拿大工程顧問們為加拿大三層政府所作的各種不同工作。但是我要指出加拿大政府亦有很大的工程部門——工務局、公路局、城市工程、國家研究中心都有工程師從事設計、研究和建築工作。然而他們承認由於時間上的問題或特別的需要，定要一個工程顧問才行。因為沒有一個團體能有那麼多人才去解決所有的問題。諸位已經聽過利用工程顧問的好處。正如我今天向各位介紹一樣，我敢保證加拿大政府從工程顧問得到的利益不少。當然我們亦承認這個行業對加拿大的建設作了主要的貢獻。

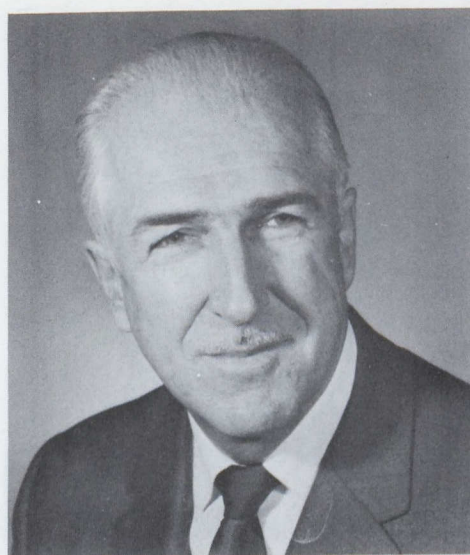


LESLIE JAMES RODGER

Mr. Rodger is a career public servant, having served the Government of Canada since 1939.

He is at present Assistant Deputy Minister, Administration, of the Canadian Department of Industry, Trade and Commerce. He formerly held the post of General Director, Office of Promotional Services.

Mr. Rodger also served as General/Director of Canada's Trade Exposition in Peking in August and September, 1972.



罗爵利

罗爵利先生自1939年起一直在加舒大政府中，担任公职。现任工商贸易部助理副部长（行政）。曾任：同部推广科科长，1972年八月至九月加舒大北京商展主任。



JOHN BRUCE MOTTA

Mr. Motta is Chief of the Consulting Services Division of the Canadian Department of Industry, Trade and Commerce.

Prior to joining the Department in 1968, Mr. Motta spent 16 years in the Canadian electrical manufacturing industry and held marketing and engineering management positions with Canadian General Electric Co. Ltd., and S.A. Armstrong Ltd.

In the Department of Industry, Trade and Commerce, Mr. Motta has been a member of the Electrical and Electronics Division; Chief of the Planning and Program Division, Fairs and Missions Branch. He is a member of the Association of Professional Engineers of Ontario.



莫 泰

莫泰先生现任加舒大工商贸易部顾问业务组主任。他从1968年起任现职。

莫先生在加舒大电气制造工业界服务了11年。先后在加舒大G.E.有限公司，和S.A. ARMSTRONG 有限公司，担任销售和工程主管的职位。

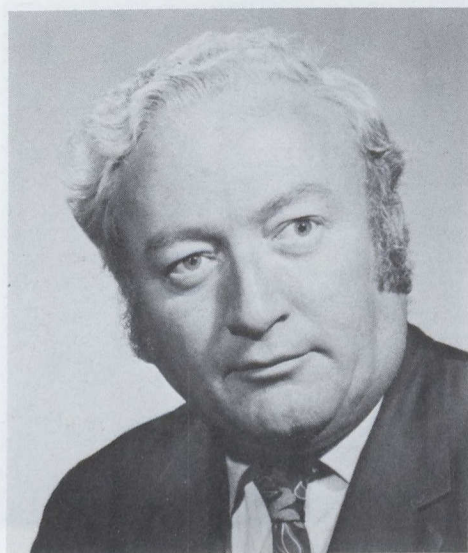
在本部内，他担任过下列的职位：电气和电子组职员；商展组计划及程序科主任。他是ONTARIO省工程师协会会员。



PAUL D. DONOHUE

Mr. Donohue is Chief of the Asia Division, Pacific, Asia and Africa Bureau of the Canadian Department of Industry, Trade and Commerce, a position to which he was appointed in March of this year.

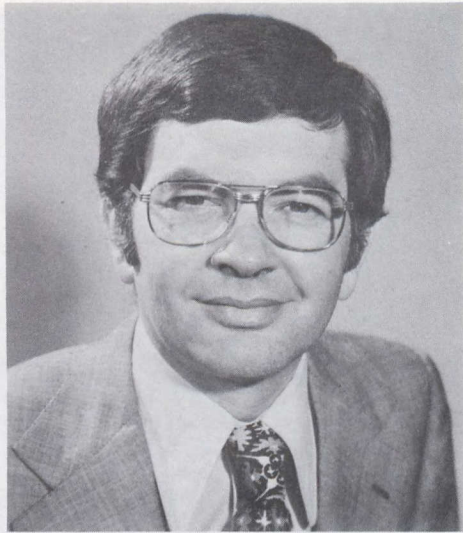
Mr. Donohue spent a number of years in private industry marketing fabricated steel products prior to joining the Trade Commissioner Service of the former Department of Trade and Commerce in 1962. He has since served as Assistant Commercial Secretary for Central America and Panama; Consul and Trade Commissioner in Chicago, U.S.; and Commercial Secretary in Athens, Greece. He was with the Department's International Financing Branch before taking up his present duties.



唐乐后

唐乐后先生现任加舒大工商贸易部，太平洋亚非局亚洲组主任。唐先生于本年三月就任。

唐先生原来在工业界服务多年，制造各种钢材。1962年加入前商业贸易部贸易经销服务组。以后又历任下列各职：中美洲巴舒马区助理商业秘书；驻美国芝加哥领事及贸易专员。驻希腊雅典商务秘书。在就任本职以前，他在本部国际财务组服务。



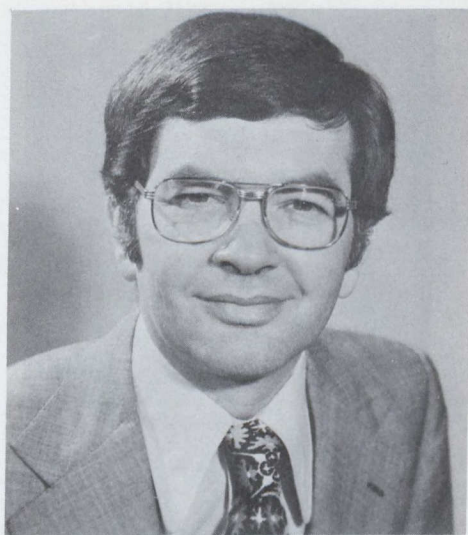
ALLAN N. LEVER

MISSION CO-ORDINATOR

Mr. Lever is Project Manager, Pacific, Asia and Africa Division of the Fairs and Missions Branch, Canadian Department of Industry, Trade and Commerce.

He joined the Department in 1972 as Executive Assistant to the General Director, Office of Promotional Services, and later as Executive Assistant to the Assistant Deputy Minister, Administration.

While with the Office of Promotional Services, Mr. Lever served on the departmental committee responsible for the organization of the Peking Trade Exposition. Since then he has been Mission Co-ordinator for the Canadian Electrical Power Mission to China and the Trade Development Mission to the South Pacific.



李 甫

顾问团联络员

李甫先生现任加舒大工商贸易部，贸易组，太平洋和亚非地区科，专案业务经理。

他于1972年加入本部，担任业务推广科，科长的执行助理。以后又担任助理副部长（行政）的执行助理。

在推广科的任期内，芮德并担任贸易部部委，负责筹组北京工商业展览会。以后历任加舒大电力访华团联络员；加舒大访南非商业促进团联络员等职。



JAMES W. MACLAREN

Mr. MacLaren is President of James MacLaren Limited, a position he has held since 1962.

He began his career in 1947 with Gore and Storie Limited working on waterworks and sewage projects and has since gained extensive experience in all phases of water supply and distribution, sewerage and sewage disposal, drainage and flood control.

Mr. MacLaren is a member of the Associations of Professional Engineers of Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Manitoba and British Columbia. He is also a member of the Engineering Institute of Canada, the Association of Consulting Engineers of Canada and the Canadian Institute on Pollution Control (WPCF).



麦籟润

麦籟润先生自从1962年起一直担任 JAMES MACLARREN 有限公司总裁。

他于1947年加入 GORE STORIE 有限公司，参加用水和排水工程的工作，因此在给水，配水，污水处理，洩水和制洪等各方已，获得丰富的经验。

麦先生是下列各学会会员：PRINCE EDWARD ISLAND, NOVA SCOTIA, NEW BRUNSWICK, ONTARIO MANITOBA 和 BRITISH COLUMBIA 工程学会；加拿大工程学会；加拿大顾问工程师协会；加拿大污染控制学会。



R.A. PILLMAN

Mr. Pillman is President of CIPM, Canadian International Project Managers Limited. He was appointed to the position in 1972.

He is also Chairman of Acres International Limited which he joined in 1948. During his career he has worked on many major development projects in Canada, Asia, Africa and Latin America.

Mr. Pillman is a member of the Association of Professional Engineers of Ontario, the Association of Consulting Engineers of Canada, the Canadian Export Association for Latin America and the Pan American Development Foundation.

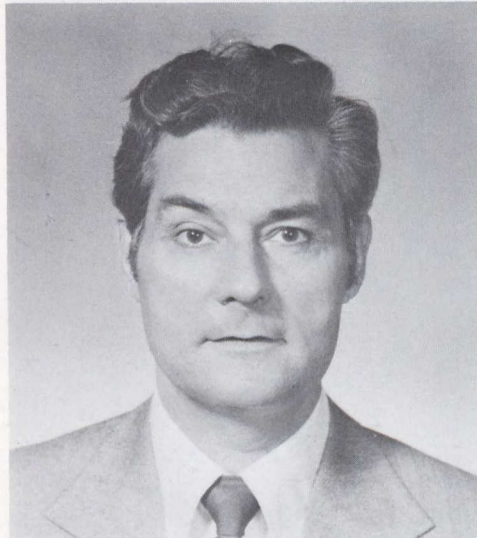


裴立文

裴立文先生现任加舒大国际工程管理有限公司 (CANADIAN INTERNATIONAL PROJECT MANAGERS LTD. 简称 C.I.P.M.) 总裁。他于 1972 年受任该职。

1948 年，他加入 ACRES INTERNATIONAL 有限公司。现任该公司主席。他参加过加舒大，亚洲，非洲，和拉丁美洲等地的主要开发工程。

裴先生是下列协会会员：ONTARIO 工程师协会；加舒大顾问工程师协会；加舒大出口贸易协会；拉丁美洲和泛美开发基金会加舒大协会。

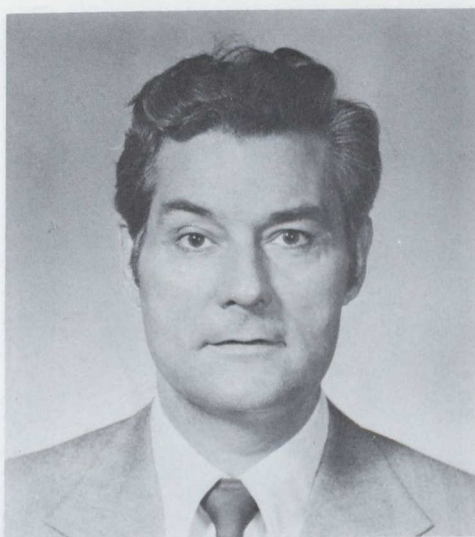


HERBERT A. HOYLES

Mr. Hoyles is the founding Principal and Chairman of the Hoyles Niblock Group of Companies, telecommunications consulting engineers.

He has 27 years experience in the fields of telecommunication system engineering, project management and regulatory practice in Canada, the United States and 13 other countries. Mr. Hoyles and his associates have been responsible to foreign government clients for the organization and establishment of regulatory agencies and the design and construction of national communications and broadcasting systems.

Mr. Hoyles has been appointed to Canadian Government Overseas Study Missions and elected to office in various professional associations, societies and technical advisory agencies.



贺义乐

贺义乐先生现任 HOYLES NIBLOCK 社团所属各公司和所辖电仪顾问工程师的主席，并且是各公司的主要筹建人。

他在电仪系统工程方面，有27年的经验。曾经在加舒大，美国和13个其他国家管理过大规模的工程计划。贺义乐先生和他的同仁曾经受外国政府的委托，代建管理机构，和代为设计和修建国营电仪和广播系统。

贺先生已经被委任为加舒大政府海外研究团团员，并且历次当选为各种技术协会，学会和技术顾问团体的负责人。



YVES BEAUREGARD

Mr. Beauregard is President and Director General of Lamarre Valois International Limited, a position he has held since 1973.

A specialist in transportation engineering, Mr. Beauregard started his career in 1952 as a Resident Engineer with the Highway Department of the Province of Quebec. He subsequently became Traffic Engineer and Technical Adviser co-ordinating the Trans-Canada Highway project for the Quebec Department. While with the Department, he was loaned to the United Nations and sent as a traffic and transportation expert and adviser to the Government of Cameroon.

Mr. Beauregard joined Lamarre Valois International Limited in 1965 as Executive Director and/Chief Engineer and, before taking his present duties, was sent to Dakar, Senegal, in charge of the company's office there. He is a member of the Quebec Corporation of Engineers, the Engineering Institute of Canada and the Association of Professional Engineers of Ontario.



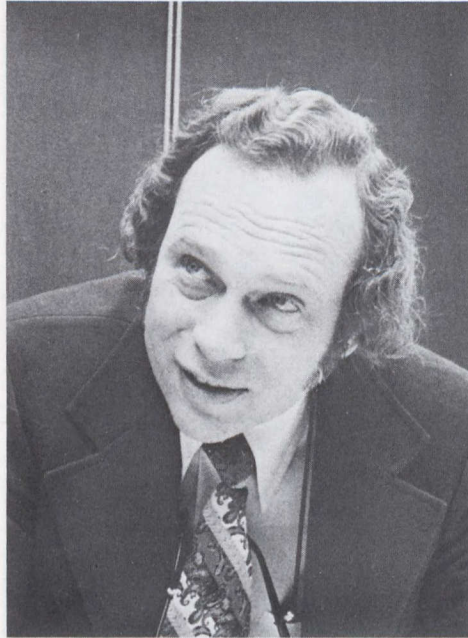
包睿戈

包睿戈先生自 1973 年起担任 LAMARRE VALOIS 国际有限公司的董事长和总裁。

包先生专长于运输工程，他的事业发轫于 1952 年，担任 QUEBEC 省公路部驻工地工程师。以后改任交通工程师和技术顾问代表 QUEBEC 省协调横贯公路工程。在本部任职期间，他被借调往联合国，受派往喀麦隆国担任交通运输顾问的任务。

1965 年，包先生参加 LAMARRE VALOIS 国际有限公司担任执行董事和总工程师。在担任现职以前，他被派往 DAKAR, SENEGAL 管理该地办事处的业务。他是下列协（学）会会员：QUEBEC

省工程师协会，加舒大工程师学会，和 ONTARIO 省工程协会。

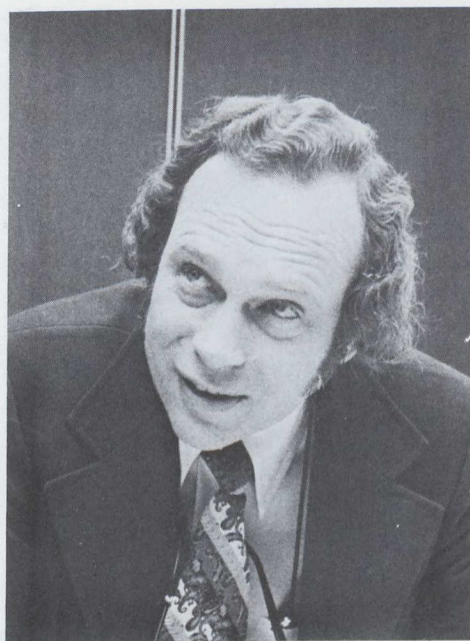


NORMAN D. LEA

Mr. Lea is Senior Principal and President of N.D. Lea & Associates Ltd., a position he has held since 1962.

Prior to taking up his present position, Mr. Lea spent many years with the Foundation Group of Companies in various capacities and served as Vice-President of Fenco in its Vancouver, British Columbia, office. He has been involved in major transportation projects around the world.

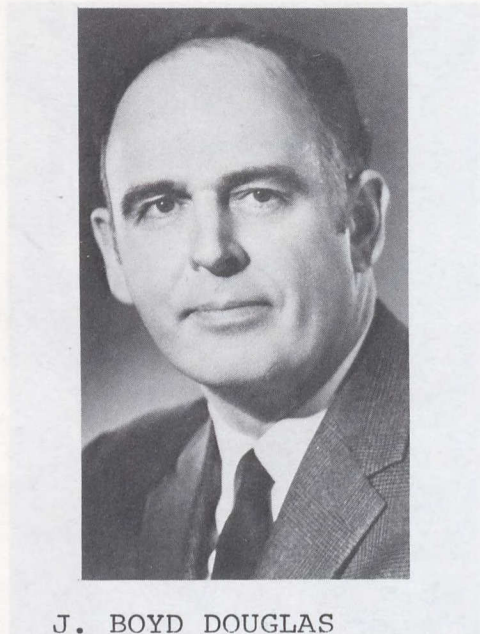
Mr. Lea is a registered professional engineer and a member of ASCE, EIC and ASA.



李若曼

李若曼先生自从1962年起一直担任李氏有限公司总裁和高级负责人。在担任本职以前，李先生在基金财团所属各公司内历任各项职务。并曾任 FENCO 公司 VANCOUVER 分公司副总裁。他曾经参加过世界各地的主要运输工程。

李先生是领照工程师，和 ASCE, EIC 和 ASA 等学会会员。



J. BOYD DOUGLAS

Mr. Douglas is President of Sandwell and Company Limited, a firm he has been associated with since 1951. He is also Chairman of Chapman, Wood & Griswold Limited and a Director of eight companies in the Sandwell Group.

Prior to his appointment as President in 1972, he served as Project Engineer, Resident Field Engineer, Chief Engineer, and Regional Manager. In 1968 he was a member of a mission to the U.S.S.R., sponsored by the Canadian and Russian governments to study the pulp and paper industry and other related forestry activities.

Mr. Douglas is a member of the Canadian Pulp and Paper Association (Technical Section), the Technical Association of the Pulp and Paper Association (U.S.A.) and is a registered professional engineer in the provinces of Ontario, British Columbia and Quebec.



德歌思

德歌思先生于1951年参加 SANDWELL 有限公司，现任该公司总裁。他又担任 CHAPMAN, WOOD, GRISWOLD 有限公司主席，和 SANDWELL 财团所属八家公司的董事。

他于1972年受任总裁。在此以前，他历任主任工程师，地盘工程师，总工程师，和地区经理等职。1968年，加拿大和苏联政府联合赞助，组织一个工程代表团，访问苏联，研究纸浆和制纸工业。他也是该团成员之一。

德先生是下列学（协）会会员：加拿大纸浆和制纸协会（技术部）；美国纸浆和制纸协会技术分会；QUEBEC, ONTARIO, BRITISH COLUMBIA 等省工程师协会。



J.E. FLAVIN

Mr. Flavin is Vice-President of Shawinigan-Pryde Flavin Company Limited. He has been with the company since its formation in 1969.

He began his career with Sparling Davis and worked on pipeline construction as engineer and construction superintendent. Mr. Flavin was also Assistant Manager of Pigott Construction; Chief Engineer of Banister Construction; and established Western Plains Consultants Ltd. He has served as consultant to the cities of Medicine Hat and Grande Prairie, in Alberta, and Regina, Saskatchewan.

Mr. Flavin is a member of the Association of Professional Engineers, Geologists and Geophysics of Alberta; the Association of Professional Engineers of British Columbia and Saskatchewan; the Engineering Institute of Canada; and the Canadian Society for Civil Engineering.



傅莱文

傅莱文先生现任 SHAWINIGAN PRYDE FLAVIN 公司副总裁。自从该公司成立之日起 (1969年) 他就一直担任该职。

他最初进入 SPARLING DAVIS 公司，担任工程师，负责铺设油管，和担任营造主任。以后他又担任 PIGOTT 营造公司副经理；BANISTER 营造公司主任工程师；和筹建 WESTERN PLAINS 顾问公司。他又担任过 SASKATCHEWAN 省 ALBERTA 市和 REGINA 市 MEDICINE HAT 镇和 GRANDE PRAIRIE 镇的顾问。

傅先生是下列各学会的会员 ALBERTA 省工程学会，地质学和地球物理学学会；BRITISH COLUMBIA 省和 SASKATCHEWAN 省工程学会；加舒大工程学会；和加舒大土木工程学会。



ANTONY N. EDGINGTON

Mr. Edgington is President of J.C. Sproule and Associates Ltd. He has 23 years experience in production engineering, reservoir engineering, natural gas engineering, engineering evaluations, economics and management.

He joined the company in 1958 and became Chief Engineer in 1964. In 1968 he was appointed Executive Vice-President and in 1970 became President.

Mr. Edgington is a member of the Canadian Institute of Mining; the Society of Petroleum Engineers of AIME; and is a registered Professional Engineer in the Provinces of Alberta and Manitoba.



艾定瞰

艾定瞰先生现任 J.C. SPROULE 联合有限公司总裁。关于下列工程，具有 23 年的经验：制造工程，蓄水工程，天然气工程，工程评价，企昼和管理。

1958 年他加入本公司，1964 年任总工程师。1968 年受任执行副总裁。1970 年任总裁。

他是下列学（协）会会员：加钲大探钲学会；AIME 石油工程师学会；MANITOBA 省和 ALBERTA 省领照工程师。

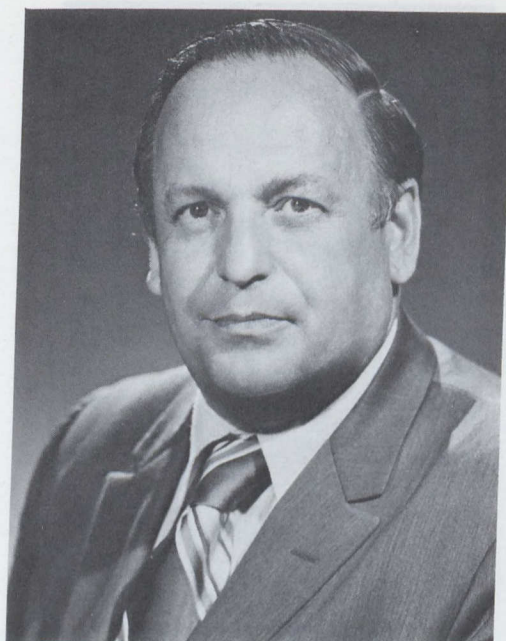


MARC BENOIT

Mr. Benoit is President and General Director of Projects of Asselin, Benoit, Boucher, Ducharme, Lapointe Inc., Consultants, active in power engineering.

With 25 years experience as consulting engineer, Mr. Benoit has worked on numerous major projects in Canada and other parts of the world. He began his career with the Shawinigan Engineering Company Limited where he was Study Engineer, Project Engineer and Office Engineer. He joined his present company in 1971.

Mr. Benoit is a member of the Corporation of Engineers of Quebec.

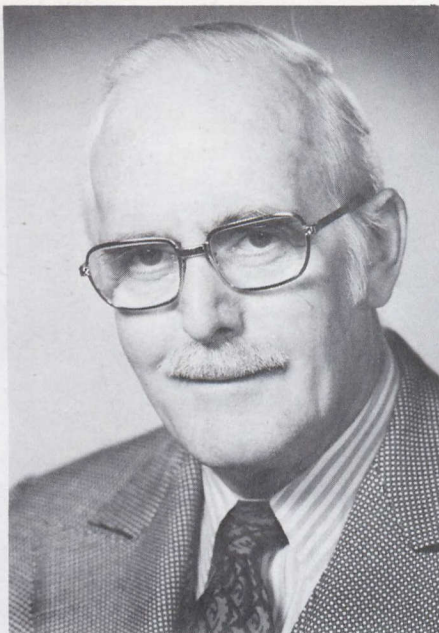


彭诺义

彭诺义先生现任 *ASSELIN, BENOIT, BOLLICHER DUCHARME, LAPOINTE* 有限公司总裁。并兼任该公司工程业务和顾问业务的总负责人。该公司早已在动力工程方面，积极展开了业务。

彭先生具有 25 年顾问业务的经验，曾经参加过加拿大和世界其他各地的许多主要工程。他最初参加 *SHAWINIGAN* 工程有限公司，担任研究工程师，主任工程师，和内勤工程师。于 1971 年加入现公司。

彭先生是 *QUEBEC* 省工程师协会会员。

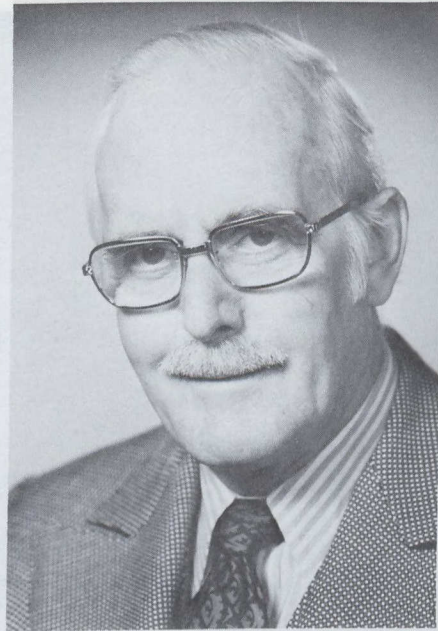


ARTHUR THOMAS GRIFFIS

Dr. Griffis was one of the founders of Watts. Griffis and McOuat Limited and, since 1965, has been President of the company and Chairman of its Australian subsidiary.

He has been on a wide variety of assignments in Canada, Australia, Africa and Europe. Of those, the most important was the study and feasibility report on the copper deposits at Akjoujt, Mauritania.

He was also responsible for acquisition, financing and development of the copper-zinc mine owned by Canadian Jamieson Mines Limited. Dr. Griffis is President and a Director of Canadian Jamieson.



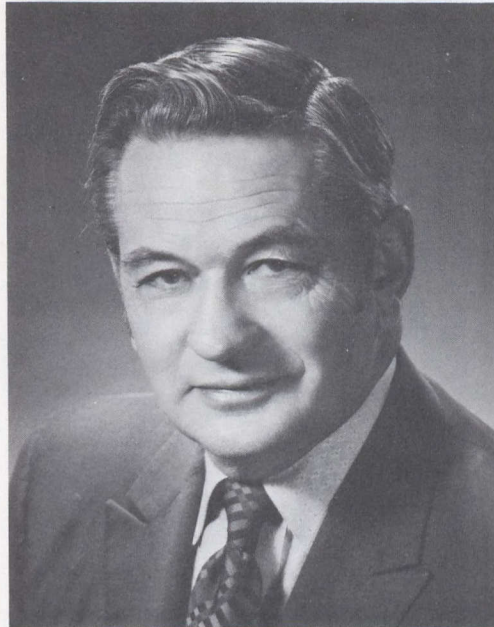
葛瑞斐

葛瑞斐博士是 *WATTS, GRIFFIS* 和 *McQUAT* 有限公司的创始人之一，自从1965年以来，就一直担任该公司的总裁，又兼任该公司澳洲附属公司的主席。

他在加舒大和澳，非，欧各地负责过许多专案工程。其中最重要的一件，要算 *MAURITANIA*

国 *AKJOUJT* 城铜矿蕴藏量研究和开采可能性报告。

他也为加舒大 *JAMIESON* 矿业有限公司，负责获有经营，和开发铜锌矿。葛博士也是 *JAMIESON* 公司的总裁和董事。



LEONARD F. WRIGHT

Mr. Wright is Vice-President of Wright Engineers Limited of Vancouver, British Columbia, a consulting design engineering company in mining and metallurgical plant design, deep sea terminals and materials handling systems.

Mr. Wright is also Vice-President of Intercontinental Engineering Limited of Vancouver, Canada, and Kent, England. He is a Director of Wright Engineers Pty., Limited, Sydney, Australia; British Pacific Properties Limited; and the Park Royal Shopping Centre Ltd.

He is a member of the Canadian Institute of Mining and Metallurgy; The American Institute of Mining, Metallurgical and Petroleum Engineers; The Association of Professional Engineers of British Columbia and Alberta; and the Association of Consulting Engineers of Canada. Mr. Wright is also a Fellow of the Institution of Mining and Metallurgy, London, England.



芮 德

芮德先生现任芮德工程有限公司副总裁。该公司设于 *BRITISH COLUMBIA* 省，*VANCOUVER* 市。承办各项工程顾问业务；采矿，冶金工厂设计，海运终站，和材料运卸系统等。

芮德先生又担任洲际工程有限公司副总裁。该公司分设于加拿大 *VANCOUVER* 市和英格兰肯特市。他又担任下列各公司的董事：澳洲西德里，芮德工程公司；不列颠太平洋产业有限公司；和御苑购物中心有限公司。

他是下列各学（协）会会员：加拿大矿冶学会；美国矿冶，石油学会；*BRITISH COLUMBIA ALBERTA* 省工程师协会；加拿大顾问工程师协会；英国矿冶学会（伦敦）。

APPENDIX A

INTERNATIONAL MODEL FORM OF AGREEMENT BETWEEN

CLIENT AND CONSULTING ENGINEER

INTERNATIONAL MODEL FORM OF AGREEMENT BETWEEN
CLIENT AND CONSULTING ENGINEER

THIS AGREEMENT made in duplicate the day
of in the year Nineteen Hundred and
between
hereinafter called "the Client", of the one part

and
Consulting Engineer(s) hereinafter called "the Consulting Engineer", of the
other part.

WHEREAS the Client is desirous that engineering services be rendered for the
following project:

(description of the reference)

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

Art. 1. Appointment of Consulting Engineer(s)

The Client hereby appoints the Consulting Engineer(s) and the Con-
sulting Engineer(s) accept(s) the appointment on the conditions as
laid down in the annexed "International General Rules for Agreement
between Client and Consulting Engineer" (IGRA 1963) and on the
terms and conditions hereinafter set forth.

Art. 2. *(Here fill in the special conditions such as applicable law, method of remuneration,*

Art. 3. *etc.; see the articles of the annexed Rules marked with*)*

etc.

In witness whereof the parties sign:

the Client:

the Consulting Engineer:

INTERNATIONAL GENERAL RULES FOR AGREEMENT BETWEEN CLIENT AND CONSULTING ENGINEER (IGRA 1963)

1. General provisions

1. 1. These rules concern the professional relationship between an individual person, corporate body or public authority (hereinafter called "the Client"), who wishes to engage the services of a Consulting Engineer, Partnership of Consulting Engineers or legal entity of Consulting Engineers (hereinafter called "the Consulting Engineer"), to advise on engineering matters or to design and supervise the construction of engineering works and the Consulting Engineer so engaged.

1. 2. Words importing the singular only also include the plural and *vice versa* without in either case altering the meaning of the context.

1. 3. The headings shall not limit, alter or affect the meaning of these rules or the Agreement.

*1. 4. If the Agreement is written in more than one language it shall be stated in the Agreement which of these languages shall be the "Ruling Language".

*1. 5. In the Agreement it shall be stated under the legal provisions of which country the Agreement has been concluded.

1. 6. The Client shall safeguard the Consulting Engineer against the consequences of any incompatibility between the provisions of these rules and/or the Agreement and the legal provisions under which the Agreement is concluded.

1. 7. These rules shall be referred to as "IGRA 1963".

2. Rights and duties of the Client and the Consulting Engineer

2. 1. The Consulting Engineer shall in all professional matters act as a faithful adviser to the Client and, in so far as any of his duties are discretionary, act fairly as between the Client and the Contractor.

2. 2. The Consulting Engineer shall exercise all reasonable skill, care and diligence in the discharge of his duties under the Agreement.

2. 3. The Client shall furnish all pertinent data and information available to him and shall give such assistance as shall reasonably be required by the Consulting Engineer for the carrying out of his duties under the Agreement.

2. 4. The remuneration of the Consulting Engineer charged to the Client according to clause 6 shall constitute his only remuneration in connexion with the Agreement, which *inter alia* implies that he shall not accept any trade commission, discount, allowance or indirect payment or other consideration in connexion with the reference.

2. 5. The Consulting Engineer shall not have the benefit, whether directly or indirectly, of any royalty on, or of any gratuity or commission in respect of, any patented or protected article or process used on or for the purpose of the Agreement unless it is mutually agreed that he may.

2. 6. The Consulting Engineer, when in charge of supervision of Works under construction shall have authority to make minor alterations to design as may be necessary or expedient, but he shall obtain the prior approval of the Client to any more substantial modification of the design and costs of the said Works and to any instruction to a Contractor which constitutes a major variation, omission or addition to the Contract. In the event of any emergency, however,

which in the opinion of the Consulting Engineer requires immediate action in the Client's interests, the Consulting Engineer shall have authority to issue such orders as required on behalf of and at the expense of the Client.

2. 7. The Consulting Engineer shall not be the medium of payments made on behalf of the Client to Contractors and/or Suppliers, unless specifically so requested by the Client. He will however issue certificates for such payments.

2. 8. The Client shall give his decision on all sketches, drawings, reports, recommendations and tender documents laid before him by the Consulting Engineer in such reasonable time as not to delay the work of the Consulting Engineer.

2. 9. The Consulting Engineer may call in the assistance of other Consultants or Experts. He shall be entitled to charge the ensuing costs to the Client when prior approval in writing has been obtained.

2. 10. The copyright of all documents prepared by the Consulting Engineer in connexion with the Agreement rests with the Consulting Engineer. The Client shall not be entitled either directly or indirectly to make use of these documents for the carrying out of the work other than under the supervision of the Consulting Engineer and/or of any additional or similar work without prior approval of the Consulting Engineer and without additional remuneration.

2. 11. The Consulting Engineer shall have the right, subject to the Client's approval, which shall not be withheld unduly, to publish descriptive articles with or without illustrations, relevant to the reference either on his own account or in conjunction with other parties concerned.

3. Preparation, conclusion, alteration and termination of the Agreement

3. 1. The Agreement is considered to have come into force immediately upon the signature of the Form of Agreement or alternatively upon the signature of other documents clearly indicating the intention of both parties to collaborate on the basis of these Rules.

3. 2. Should circumstances arise which call for modifications of the Agreement these may be made by mutual consent given in writing. Proposals in this respect from one party shall be given due consideration by the other party.

3. 3. The Consulting Engineer shall not have the right to assign or transfer the benefit or obligation of the Agreement or any part thereof. However, the Consulting Engineer shall be entitled at any time to take into partnership another partner or partners (or directors) and he or they shall thence be deemed to be included in the expression "the Consulting Engineer".

3. 4. The Agreement shall not be dissolved by the death of the Client. His rights and obligations shall pass to his Successors.

3. 5. Should the Consulting Engineer, being an individual, die or be prevented by illness or any other circumstance beyond his control from performing the obligations implied by the Agreement or having it performed entirely, the Agreement comes to an end without prejudice to the accrued rights of either party against the other.

The Client shall in that case owe the Consulting Engineer or his Successors and Assigns against surrender of the documents necessary for the continuation of the work in so far as they are available, such part of the remuneration as corresponds to the state of the work of the Consulting Engineer under the Agreement, including any reimbursable costs and those costs (if any) ensuing for the Consulting Engineer or his Successors or Assigns from contracts already entered into in respect of the reference, in so far as they are not yet reimbursed by the Client.

3. 6. Should the Consulting Engineer be a partnership or legal entity the Agreement shall not be dissolved by the death or retirement of a member of the partnership or a director of the legal entity.

3. 7. Should the Consulting Engineer be unable to fulfil his obligations under the Agreement owing to circumstances beyond his control or owing to some unreasonable action of the Client towards him or because the Client does not meet his obligations under the Agreement, he is entitled to suspend his activities and/or to cancel the Agreement in which latter case the provisions referred to under 3. 5 apply, without prejudice to his right to claim damages from the Client if there are grounds to.

3. 8. In the event of the whole or any part of the Works being postponed or abandoned or if for any reason whatsoever the Client cancels the Agreement as a whole or a part of it the same amounts are due to the Consulting Engineer as referred to under 3. 5 increased by one quarter of the remuneration agreed upon for that part of the Works which, due to the aforesaid circumstances, will not be completed by the Consulting Engineer. If the remuneration is on a time-salary basis in accordance with 6. 1 under A the Consulting Engineer shall be entitled to payment during a reasonable time for those of his staff who have been working on the reference and who have to be transferred to other jobs in addition to the amounts due to him as referred to under 3. 5.

3. 9. If, within two years, the postponed Works or any part thereof shall again proceed, any relevant payments made under 3. 8 shall rank as payments on account towards the total fee actually payable, it being understood that the extra time spent by the Consulting Engineer in connexion with the resumption of the postponed Works and the actual costs of the additional work will be subject to an additional charge.

4. Liability of the Consulting Engineer

*4. 1. The Consulting Engineer is liable for the consequences of errors and omissions on his part or on the part of his employees in so far as specified in the Agreement and to the extent mentioned therein and with the limitations referred to hereunder.

4. 2. If according to the Agreement the Consulting Engineer has certain liabilities for errors and omissions the indemnification to be paid by the Consulting Engineer shall only be based on the seriousness in character thereof and shall be determined in relation to the Consulting Engineer's fee for the Works and shall never be in excess of that fee.

4. 3. The liability of the Consulting Engineer does not cover costs other than those for the reinstatement of the Works. All liability for consequential damages is excluded.

4. 4. The liability of the Consulting Engineer (if any) expires after two years from the date of completion of the relevant part of the Works.

4. 5. The Consulting Engineer has no liability whatsoever for any part of the Works not designed by him or under his responsibility or which have not been constructed under his supervision.

4. 6. The Consulting Engineer has no liability whatsoever for any part of the Works for which the liability rests with the Contractor or the Supplier.

4. 7. The Consulting Engineer has no liability whatsoever for any damage resulting from any act of Contractors or Suppliers which is not in accordance with the contract documents or the Consulting Engineer's instructions.

4. 8. The Consulting Engineer has no liability whatsoever for any violation of legal provisions or rights of third parties unless these provisions or rights have been specifically brought to the notice of the Consulting Engineer by the Client in writing.

5. Settlement of disputes

5. 1. Any dispute or difference arising out of the Agreement and/or the provisions of these Rules, including those considered as such by only one of the parties, shall be finally settled under the Rules of Conciliation and Arbitration of the International Chamber of Commerce in Paris by one or more arbitrators appointed in accordance with the said Rules.

6. Remuneration of the Consulting Engineer

*6. 1. The remuneration of the Consulting Engineer may be agreed upon according to one or more of the following systems :

- A. On a time-salary basis plus reimbursable costs as defined in 6. 9 ;
- B. As a percentage of the cost of the Works as defined in 6. 6 plus reimbursable costs as defined in 6. 9 ;
- C. As a lump sum plus reimbursable costs as defined in 6. 9.

6. 2. If the Agreement concerns construction of Works the remuneration payable to the Consulting Engineer covers, unless otherwise agreed upon :

I. The preparation of such preliminary drawings, estimates and other engineering documents to enable the proposals for the construction of the Works to be submitted for approval by the Client, including as may be necessary :

- (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 subsoil, tide or weather, and arranging on the Client's behalf for boring tests, trial pits, test piling, models or other investigations agreed to be necessary ;
 - (d) Consultation with any architect appointed by the Client regarding any architectural matters related to the Works and with any other Consultant appointed by the Client in regard to specialized advice ;
 - (e) The making of such modifications in the outline drawings and estimates of the Works in connexion with the aforesaid consultations as may be approved by the Client.
- II. The preparation of the drawings, engineering documents and calculations required for the formal approval of any appropriate Government Department or Public Authority to the construction of the Works and the preparation of all drawings and other documents concerning Works to be tendered for, 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.
- III. The supervision and the performance of other services in connexion with the carrying out of the Works including as may be necessary in the particular case :
- (a) 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 Engineer except on behalf of the Client and with his authority in writing ;
 - (b) Advising as to the preparation of the contract to accepted tenders ;
 - (c) Preparing any further plans, designs and drawings necessary for the carrying out of the Works ;
 - (d) Examining and approving detailed drawings submitted by the Contractor ;
 - (e) Making arrangements on behalf of the Client for the inspection and testing during the manufacture of such materials and plant as are usually inspected and tested ;
 - (f) Issuing instructions to Contractor(s) and generally supervising the execution of the Works, including such site visits as the Consulting Engineer considers necessary ;
 - (g) Issuing all certificates for payments to the Contractor(s) and other certificates as required by the Client ;
 - (h) Supervising acceptance tests on site ;
 - (i) Assisting in settling disputes of differences that may arise between the Client and (a) Contractor(s) excepting litigation and arbitration ;
 - (j) On completion of the Works revise his drawings in accordance with alterations agreed during the execution.

*6. 3. If the remuneration is agreed on a time-salary basis according to 6. 1 under A, the Agreement shall state the *per diem* charge for the Consulting Engineer or the principals of the firm and the charge to be added thereto and to the pay-roll costs to cover general overhead expenses and profit, this charge being given as a percentage of these basic costs. Time spent in travelling in connexion with the Works is chargeable.

6. 4. In the case referred to under 6. 3, time spent by clerical staff in the head-office of the Consulting Engineer shall not be chargeable unless otherwise agreed upon.

*6. 5. If the remuneration is agreed upon as a percentage of the cost of the Works plus reimbursable costs according to 6. 1 under B that percentage shall be mentioned in the Agreement.

6. 6. If in the case referred to under 6. 5 the Works are carried out, as cost of the Works shall be considered unless otherwise agreed upon :

- (a) The amount certified to the Contractor, or the amount certified as cost of the Works if carried out by direct labour of Works designed, specified or supervised by the Consulting Engineer, before deduction of liquidated damages or penalties (if any) ;
- (b) A fair valuation of any labour, 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.

The cost of the Works shall *not* include the following items :

- (i) Administrative expenses incurred by the Client ;
- (ii) Payments made to the Consulting Engineer ;
- (iii) Salaries, travelling, out-of-pocket and office expenses of resident site staff ;
- (iv) Interest on capital during construction and the cost of raising moneys required for carrying out the construction of the Works ;
- (v) Cost of land and way-leaves.

6. 7. If in the case referred to under 6. 5 the Works are not carried out, as cost of the Works shall be considered the lowest acceptable tender received for the execution of the Works or for lack of such the Consulting Engineer's estimate of costs submitted to the Client.

*6. 8. If the remuneration is agreed upon as a lump sum plus reimbursable costs according to 6. 1 under C the lump sum shall be mentioned in the Agreement.

6. 9. The following costs shall be regarded as reimbursable :

- (a) The costs of all available documents needed in connexion with the Agreement such as cadastral documents, maps, drawings, aerial photographs, records, reports, etc. ;

- (b) All costs of site surveys such as terrestrial and aerial surveys, soil mechanical surveys and laboratory investigations, borings, test piles, etc. ;
- (c) The costs of such specialized professional advice and laboratory investigations as may be obtained by agreement with the Client ;
- (d) The costs of instruments mentioned in the Agreement or afterwards agreed upon with the Client ;
- (e) Rents of instruments made available by the Consulting Engineer for the carrying out of the Agreement and investigations mentioned above and during the execution of the Agreement ;
- (f) The travelling, transport, board and lodging and other such expenses of the Consulting Engineer and his staff ;
- (g) The costs of reproduction, multiplication and dispatch of all documents, reports, drawings, maps, etc. ;
- (h) The costs of postage, telephones and telegrams in so far as they are not local ;
- (i) The costs of advertising for tenders.

*The following costs will equally be regarded as reimbursable subject to overhead charges as agreed upon :

- (j) The costs of shop drawings in the case of steel work and detailed drawings of reinforcement steel in the case of reinforced or prestressed concrete designs except in the case of remuneration on a time-salary basis ;
- (k) The costs of the Consulting Engineer's staff on site necessary for field investigations and for the supervision of the construction and administration of the Works by the Resident Staff ;
- (l) The costs of testing of materials and of the inspection and testing during manufacture and/or after delivery of such materials and plant as are usually inspected and tested by Consulting Engineers ;
- (m) The fees and expenses in connexion with lawsuits, arbitration proceedings etc. against or by third parties in so far as the assistance of the Consulting Engineer in this respect is required by the Client.

6. 10. In case of excessive delay on the part of the Client or of any Contractor or the taking by the Client of the Works or any part thereof out of the hands of any Contractor due to his failure properly to perform the relevant Contract, the Consulting Engineer shall be entitled to additional remuneration

6. 11. 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 and/or investigations in progress, which require the alteration or remaking of any specification, drawing or other documents prepared in whole or in part by the Consulting Engineer, the whole of the cost of revising, amending or reproducing documents to bring the work of the Consulting Engineer up to the stage at which it was modified shall be the subject of additional payment, computed on a time basis together with all reimbursable costs incurred.

7. Payments

*7. 1. The Client shall pay to the Consulting Engineer advance payments to be mentioned in the Agreement as imprest accounts. These advance payments will be taken into account when the final payment is made.

*7. 2. If the Agreement concerns construction of Works, the Client shall pay to the Consulting Engineer unless otherwise agreed instalments at about the following stages of the Works, the proportions being stated in the Agreement:

- (a) On submission of the preliminary design ;
- (b) On submission of the proposal for the definite design ;
- (c) On submission of the tender documents ;
- (d) On completion of the Works.

Provisions should also be made for payment of instalments during the construction period.

7. 3. If the remuneration is agreed on a time-salary basis according to 6. 1 under A, it will be payable monthly.

7. 4. If the remuneration is agreed as a percentage of the cost of the Works according to 6. 1 under B, the percentages mentioned under 7. 2 will be taken from the Consulting Engineer's estimates of cost of the Works.

7. 5. No matter how the remuneration is agreed upon the reimbursable costs shall be payable monthly.

7. 6. Remunerations shall be paid to the Consulting Engineer within one month after submission of the invoices by the Consulting Engineer. If the Client fails to pay the Consulting Engineer within three months after the date of submission of the invoice the Consulting Engineer is entitled to claim interest as from the date of the invoice.

7. 7. Unless otherwise agreed all payments to the Consulting Engineer shall be made into the Bank Account of the Consulting Engineer in his own country.

8. Currency

8. 1. Unless otherwise agreed, payments to the Consulting Engineer shall be made in the currency of his own country.

*8. 2. If payments are agreed in currency other than that of the Consulting Engineer's country, the rate of exchange shall be stated in the Agreement.

9. Damage

9. 1. If at any time before the completion of the Works under the Agreement any part of the Works or the equipment thereof shall be damaged or destroyed as a consequence of operations of war, political disturbance or other cause beyond the control of the Consulting Engineer, the Client shall pay to the Consulting Engineer the appropriate remuneration for any additional work which may be required to be designed and/or supervised by him as a result of such damage or destruction and a compensation for the damage resulting from such operation or cause.

APPENDIX B

TYPICAL GENERAL CLAUSES

OF UNDP CONTRACTS

GENERAL CONDITIONS

01 Privileges and Immunities of Contractor and Contractor's Personnel

The UNDP will obtain for the Contractor exemption from or reimbursement for the cost of any taxes, duties, fees or levies which may be imposed in the country on salaries or wages earned by the Contractor's foreign personnel in the execution of the Project and on any equipment, materials and supplies which the Contractor may bring into the country in connection with this Project or which after having been brought into the country may be subsequently withdrawn therefrom. It is agreed that the UNDP shall not be liable beyond the amount of said taxes, duties, fees and levies for any failure or delay in obtaining exemption or reimbursement for the Contractor or his foreign personnel.

The UNDP agrees to use its best efforts to obtain for the Contractor and his personnel (except Government nationals employed locally), to the extent granted by the Government to UNDP staff members, such facilities and immunities as the Government has agreed to grant to contractors performing services for the United Nations Development Programme within the country and to their personnel. A copy of the provision relating hereto in the Project Document concerning this Project is herewith transmitted to the Contractor for his information as Annex A to this Contract.

02 Waiver of Privileges and Immunities

Any provision, whether in an Agreement, Project Document, or any other instrument, to which the recipient Government is a party, by which the recipient Government confers benefits upon the Contractor and his personnel in the form of facilities, privileges, immunities, or exemption by reason of his performance of services for the UNDP on this Project may be waived by the UNDP where, in its opinion, the immunity would impede the course of justice and can be waived without prejudice to the successful completion of the Project or to the interests of the United National Development Programme.

03 Confidential Nature of Documents

All maps, drawings, photographs, mosaics, plans, reports, recommendations, estimates, documents and all other data compiled by or received by the Contractor under this Contract shall be the property of the UNDP, shall be treated as confidential and shall be delivered only to the UNDP Resident Representative or other authorized officials on completion of work under this Contract; their contents shall not be made known by the Contractor to any person

other than personnel of the Contractor performing services under this Contract without written consent of the UNDP.

04 Independent Contractor

The Contractor shall have the legal status of an independent contractor. Any person assigned by the Contractor to perform services under this Contract shall remain in the employment of the Contractor. Unless otherwise provided for in this Contract, the UNDP shall not be liable for claims of any kind in connection with the performance of such services. The Contractor and his employees shall conform to all applicable laws, regulations and ordinances promulgated by legally constituted authorities of the Government.

05 Contractor's Responsibility for Employees

The Contractor shall be responsible for the professional and technical competence of his employees and will select for work under this Contract, reliable individuals who will perform effectively in the implementation of the Contract, comply with laws of the Government, respect the local customs and conform to a high standard of moral and ethical conduct.

06 Assignment of Personnel

The Contractor shall not assign any personnel other than those referred to in this Contract for the performance of work in the field without the prior written approval of the UNDP. Prior to assigning any other personnel for the performance of work in the field, the Contractor shall submit to the UNDP for its consideration the curriculum vitae of any person the Contractor proposes to assign for such services.

07 Removal of Personnel

Upon written request by the UNDP, the Contractor shall withdraw from the field any personnel provided under this Contract and shall replace such personnel by others acceptable to the UNDP if the UNDP so requests. All costs and additional expenses resulting from the replacement for whatever reason of any of the Contractor's personnel shall be at the Contractor's expense. Such withdrawal shall not be considered as termination in part or in whole of this Contract under the provisions of paragraph 14 of the General Conditions.

08 Assignment

The Contractor shall not assign, transfer, pledge or make other disposition of this Contract or any part thereof or of any of the Contractor's rights, claims or obligations under this Contract except with the prior written consent of the UNDP.

09 Sub-Contracting

In the event the Contractor requires the services of sub-contractors the Contractor shall obtain the prior written approval and clearance of the UNDP for all sub-contractors. The approval of the UNDP of a sub-contractor shall not relieve the Contractor of any of his obligations under this Contract, and the terms of any sub-contract shall be subject to and be in conformity with the provisions of this Contract.

10 UNDP Privileges and Immunities

Nothing in or relating to this Contract shall be deemed a waiver of any of the privileges and immunities of the UNDP.

11 Non-Employment of the UNDP Staff Members

The Contractor shall not while this Contract is in effect employ or consider the employment of UNDP employees without prior written approval of the UNDP.

12 Language, Weights and Measures

Except as may be otherwise specified in the Contract, the English language shall be used by the Contractor in all written communications to the UNDP with respect to the services to be rendered and with respect to all documents procured or prepared by the Contractor pertaining to the work. The project surveys shall be based on the metric system of weights and measures, and estimates of quantities involved shall be made and recorded in metric units except as otherwise specified in the Contract.

13 Force Majeure

Force Majeure as used herein shall mean acts of God, laws or regulations, industrial disturbances, acts of the public enemy, civil disturbances, explosions and any other similar cause of equivalent force not caused by nor within the control of either party and which neither party is able to overcome. As soon as possible after the occurrence of any cause constituting force majeure, the Contractor shall give notice and full particulars in writing to the UNDP of such force majeure if the Contractor is thereby rendered unable, wholly or in part, to perform his obligations and meet his responsibilities under this Contract. In this event, the following provisions shall apply:

- (a) The obligations and responsibilities of the Contractor under this Contract shall be suspended to the extent of his inability to perform them and for as long as such inability continues. During such suspension and in respect of work suspended, the Contractor shall be entitled only to reimbursement by the UNDP against appropriate vouchers of the essential costs of maintenance of any of the Contractor's equipment and of per diem of the Contractor's personnel rendered idle by such suspension.
- (b) The Contractor shall within fifteen (15) days of the occurrence of the force majeure submit a statement to the UNDP of estimated expenditures for the duration of the period of suspension.
- (c) The term of this Contract shall be extended for a period equal to the period of suspension taking, however, into account any special conditions which may cause the time for completion of the work to be different from the period of suspension.
- (d) If the Contractor is rendered permanently unable, wholly or in part, by reason of force majeure to perform its obligations and meet his responsibilities under this Contract, the UNDP shall have the right to terminate this Contract on the same terms and conditions as are provided for in Section 14 "Termination", except that the period of notice may be seven (7) days instead of thirty (30) days.
- (e) For the purpose of the preceding sub-section, the UNDP may consider the Contractor permanently unable to perform in case of any period of suspension in excess of ninety (90) days. Any such period of ninety (90) days or less shall be deemed temporary inability to perform.

14 Termination

The UNDP may terminate this Contract in whole or in part at any time upon thirty (30) days' notice of termination to the Contractor. In the event such termination is not caused by the Contractor's negligence or fault, the UNDP shall be liable to the Contractor for payment in respect of work already accomplished, for the cost of repatriation of the Contractor's personnel, for necessary terminal expenses of the Contractor, and for the cost of such urgent work as is essential and as the Contractor is asked by the UNDP to complete. The Contractor shall keep expenses at a minimum and shall not undertake any forward commitment from the date of receipt of any notice of termination.

15 Workmen's Compensation and other Insurance

- (a) The Contractor shall provide and thereafter maintain appropriate workmen's compensation and liability insurance with respect to and prior to the departure for overseas employment under this Contract of all employees who are hired outside the country of the Government and who are now citizens of said country.
- (b) The Contractor shall provide and thereafter maintain insurance in an appropriate amount against public liability for death, bodily injury or damage to property arising from the operation in the country in which the contract is to be performed of motor vehicles boats or airplanes owned or leased by the Contractor. The Contractor warrants that similar insurance shall be provided and maintained in respect of all vehicles or boats owned or leased by foreign personnel of the Contractor and used by them in the country in which the Contract is to be performed.
- (c) The Contractor shall comply with the labour laws of the Government providing for benefits covering injury or death in the course of employment.
- (d) The Contractor undertakes that provisions to the same effect as the provisions of this Article will be inserted in all sub-contracts or subordinate contracts made in performance of this Contract, except sub-contracts or subordinate contracts exclusively for furnishing materials or supplies.

16 Indemnification

The Contractor shall indemnify, hold and save harmless and defend at its own expense the UNDP, its officers, agents, servants and employees from and against all suits, claims, demands and liability of any nature or kind, including costs and expenses arising out of acts or omissions of the Contractor or his employees or sub-contractors in the performance of this Contract. This clause shall extend to claims or liability in the nature of workmen's compensation claims or liability or those arising out of the use of patented inventions or devices.

17 Disputes - Arbitration

Any dispute arising out of the interpretation or application of the terms of this Contract shall, unless it is settled by direct negotiations, be referred to arbitration in accordance with the rules then obtaining of the International Chamber of Commerce, The UNDP and the Contractor agree to be bound by any arbitration award rendered in accordance with this section as the final adjudication of any such dispute.

18 Conflict of Interest

No employee of the Contractor assigned to perform work under this Contract shall engage, directly or indirectly, either in his own name or through the agency of another person, in any business, profession, or occupation in the country of the Government; nor shall he make loans or investments to or in any business, profession, or occupation in said country.

19 Source of Instruction

The Contractor shall neither seek nor accept instructions from any authority extended to the UNDP in connection with the performance of its services under this Contract. The Contractor shall refrain from any action which may adversely affect the UNDP and shall fulfill his commitments with fullest regard for the interest of the UNDP.

20 Title to Equipment

Title to any equipment and supplies which may be furnished by the UNDP shall rest with the UNDP and any such equipment shall be returned to the UNDP at the conclusion of this Contract or when no longer needed by the Contractor. Such equipment, when returned to the UNDP shall be in the same condition as when delivered to the Contractor, subject to normal wear and tear.

21 Rights to Material Produced Under Contract

Title, copyrights and patent rights to any and all material produced under this Contract shall be vested in the UNDP. Unless authorized in writing by the UNDP, the Contractor shall not advertise or otherwise make public the fact that he is performing or has performed services for the UNDP or use the name, emblem or official seal of the UNDP or any abbreviation of the name of the UNDP for advertising purposes or for any other purposes.

22 Amendments

No changes in or modifications of this Agreement shall be made except by mutual agreement, in writing, between the UNDP and the Contractor.

23 Bankruptcy

Should the Contractor be adjudged bankrupt, or should the Contractor make a general assignment for the benefit of his creditors, or should a receiver be appointed on account of the Contractor's

insolvency, the UNDP may, without prejudice to any other right or remedy it may have under the terms of this Contract, terminate this Contract forthwith by giving the Contractor written notice of such termination.

APPENDIX C

TYPICAL GENERAL CLAUSES

OF IBRD CONTRACTS

NAME OF PROJECT

CONTRACT FOR CONSULTANTS SERVICES

between

**INTERNATIONAL BANK FOR RECONSTRUCTION
AND DEVELOPMENT**

and

(name of Consultant)

Dated _____

CONTRACT FOR CONSULTANTS' SERVICES

CONTRACT (hereinafter, together with all Appendices attached hereto and forming an integral part hereof, called the "Contract") dated the _____ day of _____ between the INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT (hereinafter called the "Bank") acting solely as Participating and Executing Agency of the United Nations Development Programme (hereinafter called the "UNDP") and _____ (name of Consultant) (hereinafter called the "Consultants"):

WHEREAS the Government of _____ (name of country) (hereinafter called the "Government") has applied to the UNDP for assistance in financing a _____ (name of project) .

WHEREAS a Project Document for such assistance and for the financing thereof, substantially in the form heretofore furnished to the Consultants, will be signed among the Government, the UNDP and the Bank; and

WHEREAS the Consultants are consultants retained pursuant to the Project Document;

NOW THEREFORE it is hereby agreed by and between the parties hereto as follows:

ARTICLE I

Special Definitions

Section 1.01. Unless the context otherwise requires, the following terms wherever used in this Contract have the following meanings:

- (a) "foreign currency" means any currency other than the currency of the Government;
 - (b) "local currency" means the currency of the Government;
 - (c) "dollars" and the sign "\$" mean dollars in the currency of the United States of America;
 - (d) "Canadian dollars" and "Can\$" mean the currency of Canada;
 - (e) "Starting Date" means the date from which the periods specified for the submission of reports are measured, as set forth in the Time Schedule included in Appendix A hereto, and after which the Consultants may receive payments hereunder.
- Unless otherwise agreed between the Bank and the Consultants, the Starting Date shall be _____ (date) _____ .

ARTICLE II

The Services

Section 2.01. The work to be performed by the Consultants under this Contract (hereinafter called the "Services") is described in the Terms of Reference set forth in Appendix A hereto.

Section 2.02. The Consultants shall carry out the Services with due diligence and efficiency, in a practical manner designed to promote the purposes of the Project Document and with due regard to the obligations of the parties thereto.

Section 2.03. (a) Except as the Bank shall otherwise agree, the Services shall be completed within_____ months after the Starting Date.

(b) The Consultants shall promptly inform the Bank of the date of arrival of their senior personnel in the territories of the Government.

Section 2.04. (a) The Services shall be carried out by the personnel of the Consultants set forth in Appendix B and for the periods of time indicated therein. Substitutions for such personnel shall not be made without the prior approval of the Bank.

(b) Minor adjustment with respect to the time allocated for the personnel set forth in Appendix B may be made by the Consultants if required to comply with the provisions of Section 2.02 above, upon written advance notice to the Bank. For the purposes

of this Section, minor adjustment means such changes in working schedules as shall not alter the time allocated for any one individual by more than twenty per cent (20%) or one week, whichever is the longer; provided, however, that the aggregate of such adjustments does not cause payments under this Contract with respect to foreign-currency costs and local-currency costs to exceed the maximum amounts stated in Sections 3.01 and 3.03 hereof, respectively. Other adjustments will be made only after the written approval of the Bank has been obtained.

Section 2.05. Upon request by the Bank, the Consultants shall submit for prior approval by the Bank the text of any proposed sub-contracts between the Consultants and others relating to the Services, and any proposed amendment thereof, in such detail as the Bank shall specify.

Section 2.06. The Consultants shall keep accurate and systematic accounts and records in respect of the Services in such form and detail as is customary in their profession and shall permit the Bank or its designee periodically to inspect the same and make copies thereof.

Section 2.07. The Consultants shall furnish to the Bank such information related to the Services as the Bank may from time to time request.

Section 2.08. The Consultants shall submit to the Government and the Bank the reports specified in Appendix A in the languages, number of copies and within the time periods set forth in the said Appendix.

Section 2.09. (a) The Consultants shall take out and maintain insurance against loss of or damage to equipment purchased in whole or in part with funds provided under this Contract and against loss of or damage to their property, including papers and documents, necessary to the Services.

(b) The Consultants shall take out and maintain full insurance against claims by third parties resulting from acts performed in carrying out the Services.

ARTICLE III

Costs and Payments

Section 3.01. The Bank shall pay the Consultants for the items specified in this Section, in Canadian dollars or in such other freely convertible currency or currencies as the Bank shall elect from time to time, an amount not to exceed the equivalent of (amount) .

(a) Amounts at the applicable rates set forth in Appendices C-1 and C-2, calculated on the basis of the periods of time actually spent by the personnel of the Consultants in performing the Services, including necessary travel time. In all cases where it shall be necessary to compute rates for work of less than one month, such computation shall be made on a calendar-day basis for work performed away from the Consultants' home offices or for travel time (one calendar-day being equal to 1/30th of a month) and on an hourly basis for work performed in the Consultants' home offices;

(b) Cost of transportation by the most direct route to and from the Consultants' home offices or other normal duty station for purposes of the Services by personnel of the Consultants (see estimate in Appendix C-3);

(c) Cost of economy-class transportation by the most direct route for one round trip of the wives, and children under 18 years

of age, of personnel of the Consultants assigned away from the Consultants' home offices or other normal duty station for purposes of the Services for periods of six consecutive months or longer, provided that such dependents' stay in the territories of the Government shall have been for not less than 60 consecutive days' duration (see estimate in Appendix C-3);

(d) Cost of acquisition and shipment of data, equipment and reports and of production of reports (see estimate in Appendix C-4);

(e) Cost of any sub-contract authorized by the Bank as required for the Services; and

(f) Cost of items not covered in the foregoing but required for purposes of the Services, subject to prior authorization by the Bank.

Section 3.02. (a) The Bank shall pay the Consultants for the items referred to in Section 3.01 above as follows:

(i) Not later than 15 days after the end of the calendar month containing the Starting Date or of the calendar month in which this Contract becomes effective, whichever is later, an amount estimated to be the requirements for the Services performed through the end of said month, calculated on the basis of the Schedule of Payments set forth in Appendix C-6; and

(11) Not later than the 15th day of each succeeding month, except the last, during the performance of the Services, the amount set forth in such Schedule of Payments as the next monthly payment, adjusted in accordance with paragraph (b) below.

(b) Not later than 20 days after the end of each calendar month in which expenditures for the Services are made or Services are performed and of each subsequent calendar month, the Consultants shall submit to the Government for its approval an itemized statement of the foreign-currency costs described in Section 3.01 and actually incurred to the end of such month, supported where appropriate by receipted invoices. The approval of the Government shall be evidenced by the signature of the person or persons identified to the Bank for the purpose. Such approved statements shall be forwarded with all supporting invoices to the Bank by the Government. The difference between the amount of the statement for any month approved by the Government and the Bank and the amount paid or payable for the same month pursuant to this Section shall be added to or subtracted from the next scheduled payment to be made pursuant to paragraph (a) (11) above.

(c) In the event of major delay in the work of the Consultants hereunder, they shall notify the Bank. Payments pursuant to paragraph (a) above may then be suspended, in which case the

Consultants shall prepare a modified Schedule of Payments, which shall take effect after approval by the Bank, and payments under this Section shall then be resumed in accordance therewith.

(d) The final payment under this Section shall be made only after the final statement submitted by the Consultants as provided in paragraph (b) above and identified as such shall have been approved by the Government and the Bank, and the amount of such payment shall be subject to the maximum established in Section 3.01 hereof. Any amount paid by the Bank in accordance with this Section in excess of the costs actually approved by the Government and the Bank shall be reimbursed by the Consultants to the Bank within 30 days after receipt by the Consultants of notice thereof.

Section 3.03. The Bank shall also pay the Consultants for the local-currency costs specified in this Section, not exceeding, however, the sum of _____ (amount) _____ .

(a) Subsistence allowance for the Consultants' personnel at the per diem rates set forth in Appendix D-1;

(b) Cost of local transportation, services, supplies and other local expenses of the Consultants required for purposes of the Services (see estimates in Appendix D-1); and

(c) Cost of items not covered in the foregoing but required for purposes of the Services, subject to prior authorization by the Bank.

Section 3.04. (a) To cover payments due under Section 3.03, the Bank shall establish a revolving fund in an account to be designated by the Consultants, and shall deposit into said account amounts in local currency as follows:

(i) Not later than 15 days following the date of effectiveness of this Contract or the Starting Date, whichever is later, an amount estimated to be the requirements for the Services performed through the calendar month in which the deposit is made plus two months' advance estimated requirements, calculated on the basis of the applicable monthly estimates set forth in Appendix D-2; and

(ii) Not later than the 15th day of each succeeding month, the amount set forth in Appendix D-2 as the next monthly estimate, adjusted in accordance with paragraph (b) below.

(b) The Consultants may make withdrawals from such account as necessary to cover the expenditures described in Section 3.03 hereof. Not later than 20 days after the end of the calendar month containing the Starting Date and of each calendar month thereafter until the month of termination of the Services in the territories of the Government, the Consultants shall submit to the Government for transmittal to the Bank an itemized statement of the charges in local

currency incurred in the previous calendar month, supported, where appropriate, by receipted invoices. Upon approval by the Government and the Bank of the statement, the difference between such statement and the amount deposited in such account for the same month shall be added to or deducted from the amount which shall be deposited in the subsequent month in accordance with paragraph (a) (ii) above.

Section 3.05. Upon completion of the Services the Consultants shall promptly render a final accounting of local and foreign-currency costs to the Government and the Bank, in such detail as the Bank shall request.

Section 3.06. The Bank shall not be obligated to make any payment under this Contract except to the extent it shall have received funds for the purpose from the UNDP pursuant to the Project Document.

Section 3.07. Whenever it shall be necessary for the purposes of this Contract to evaluate one currency in terms of another, the conversion shall be made at the rate legally applicable at the time and place of, and to the currency utilized in, the underlying expenditure or transaction.

ARTICLE IV

Undertakings of the Government

Section 4.01. The Project Document will provide that the Government agree to:

(a) exempt the Consultants and their personnel from or bear the cost of any taxes, duties, fees, levies and other impositions imposed under its laws and regulations or the laws and regulations in effect in its territories or of any political subdivision or agency thereof on the Consultants and their personnel (other than personnel who are citizens or permanent residents of the territories of the Government) in respect of:

- (i) any payments made to the Consultants or to such personnel in connection with the carrying out of the Services;
- (ii) any equipment, materials and supplies brought into the territories of the Government for the purpose of carrying out the Services and which, after having been brought into such territories, will subsequently be withdrawn therefrom; and
- (iii) any property brought into such territories by the personnel of the Consultants and their dependents for their personal use and which, after having been brought into such territories will subsequently be withdrawn therefrom upon departure of such personnel;

(b) facilitate prompt clearance through its customs of any equipment, material and supplies required for the Services and of the personal effects of the Consultants' personnel;

(c) ensure that the Consultants' personnel and their dependents are promptly provided with any necessary entry and exit visas, residence permits, exchange permits and travel documents required for their stay in the territories of the Government;

(d) issue all necessary permits and authorizations for the carrying out of the Services; and

(e) provide the Consultants free of charge with such data, local services, equipment and facilities as are necessary for the Services, all as more specifically set forth in Appendix A to this Contract.

ARTICLE V

Ownership of Reports and Equipment

Section 5.01. Final versions of the reports submitted to the Government, and all relevant data such as maps, diagrams, plans, statistics and supporting materials compiled in performing the Services, shall be the property of the Government. Such material shall be sorted and indexed by the Consultants prior to transmittal to the Government, and the Consultants shall be permitted to retain copies thereof; provided, however, that such material shall not be used by the Consultants for purposes unrelated to this Contract without the prior written approval of the Government and the Bank.

Section 5.02. (a) Equipment purchased for the Services and paid for in whole or in part out of funds allocated by the UNDP shall be deemed to be the property of the UNDP.

(b) At the end of each calendar year, and upon the completion of the Services or any termination or suspension thereof, the Consultants shall furnish to the Government and the Bank information in the form of inventories certified by the Consultants, in respect of the equipment referred to in paragraph (a) of this Section.

(c) The equipment referred to in paragraph (a) of this Section shall, insofar as practical, be marked as being the property of the UNDP, and such markings should be clearly and readily visible.

(d) Upon completion of the Services in the territories of the Government, the disposition of such equipment by the Consultants shall be in accordance with the instructions of the Bank.

ARTICLE VI

Settlement of Disputes; Suspension and Termination

Section 6.01. Any dispute or difference arising out of this Contract or in connection therewith which cannot be amicably settled between the parties shall be finally settled under the Rules of Conciliation and Arbitration of the American Arbitration Association by one or more arbitrators appointed in accordance with the said Rules. The arbitration shall take place in New York. The resulting award shall be final and binding on the parties and shall be in lieu of any other remedy.

Section 6.02. The Bank shall be entitled by notice to the Consultants to suspend in whole or in part the disbursement of funds hereunder if the Consultants shall have failed to carry out any obligation of the Consultants under this Contract, or if any other condition arises which interferes, or threatens to interfere, with the successful carrying out of the Services or the accomplishment of the purpose thereof.

Section 6.03. (a) If any condition referred to in Section 6.02 shall continue for a period of fourteen days following such notice of suspension, then the Bank at its option may terminate this Contract.

(b) The Bank may terminate this Contract upon not less than sixty days' written notice to the Consultants.

(c) Upon receipt of such notice, the Consultants shall take immediate steps to bring the Services to a close in a prompt and orderly manner, and reduce expenditures for the purpose to a minimum.

Section 6.04. (a) The Consultants shall promptly notify the Bank in writing of any situation or of the occurrence of any event beyond the reasonable control of the Consultants which makes it impossible for the Consultants to carry out their obligations hereunder. Upon confirmation in writing by the Bank of the existence of any such situation or event or upon failure of the Bank to respond to such notice within 15 days, the Consultants shall be relieved from all liability for failure to carry out such obligations. In case of disagreement between the parties as to the existence of such situation or event, the matter shall be submitted to arbitration in accordance with Section 6.01 hereof.

(b) Upon such confirmation or failure to respond by the Bank or award by the arbitrators in favor of the existence of such situation or event, the Consultants may terminate this Contract by not less than thirty days' notice thereof in writing to the Bank.

(c) Upon giving such notice of termination to the Bank, the Consultants shall proceed in the same manner as set forth in Section 6.03 (c) hereof.

(d) In the event of termination of the Project Document pursuant to paragraph 32 of Part V thereof, this Contract shall terminate forthwith.

Section 6.05. In the event the Consultants do not receive payments as provided in Article III hereof within thirty days following the due dates, the Consultants shall promptly notify the Bank, and if not received within thirty days after such notice, the Consultants

may, without liability, terminate this Contract and the Services and recall their personnel.

Section 6.06. Upon termination of this Contract pursuant to the provisions of Section 6.03, 6.04 or 6.05 hereof, no payment shall be due to the Consultants except for Services satisfactorily performed, for expenditures incurred hereunder prior to the date of such termination, for those incident to the prompt and orderly termination of the Services and for the return travel of the Consultants' personnel and their eligible dependents.

Section 6.07. The Bank shall not be liable for any consequence of, or claim based upon, any failure on the part of any other party to the Project Document to carry out any obligation of such party under the Project Document.

ARTICLE VII

Authorized Representatives; Notices and Requests

Section 7.01. Any action required or permitted to be taken, and any document required or permitted to be executed under this Contract may be taken or executed on behalf of the Consultants by (name) or his designated representative.

Section 7.02. Any notice or request required or permitted to be given or made in this Contract shall be in writing. Such notice or request shall be deemed to be duly given or made when it shall have been delivered by hand, mail or cable to the party to which it is required to be given or made, at such party's address specified below or at such other address as the party shall have specified in writing to the party giving such notice, or making such request.

Address of Bank:

Address of Consultant:

ARTICLE VIII

Section 8.01. This Contract shall become effective upon signature by both parties or on the date when the Project Document enters into force, whichever is later. In the latter case, notice of effectiveness shall be given promptly by the Bank to the Consultants.

Section 8.02. If this Contract shall not have become effective within six months following the date thereof, this Contract and all obligations of the parties thereunder shall terminate, unless the parties agree to continue this Contract on mutually satisfactory terms and conditions.

IN WITNESS WHEREOF, the Bank and the Consultants have caused this Contract to be signed in their respective names in Washington, D. C. and in Montreal, respectively, as of the day and year first above written.

INTERNATIONAL BANK FOR
RECONSTRUCTION AND DEVELOPMENT

By _____ (name) _____

(NAME OF CONSULTANT)

By _____ (name) _____
/ Authorized Representative

11 CANADA/INDUSTRIE

62975

[illegible]

