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## **Seminar 4**

**Continuing Education: Scope and Objectives**

**Formation permanente: possibilités et objectifs**

**Fortbildung: Ziele und Möglichkeiten**

Organizer:

Jacques Brozzetti,  
France

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## Continuing Engineering Education in the Design Office

Formation continue en génie civil au bureau d'études

Fortbildung im Bauingenieurwesen im Ingenieurbüro

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Suresh Lonkar, born in 1937, got his Dr.Sc Techn. degree from ETH, Zurich, after earlier education in India. He has worked on marine and industrial structures for his Company, and simultaneously on software development for bridges and other application areas.

### **SUMMARY**

The author discusses the need to continue engineering education in the design office. Some amount of formal training is proposed, and its scope as well as the areas to be covered in the program are defined. The methodology is next described with the help of an actual example. The process of informal day to day education in the office is mentioned. Finally, relevant management issues are defined and their importance discussed.

### **RÉSUMÉ**

L'auteur souligne l'importance de poursuivre la formation au bureau d'études. Il propose quelques directives formelles en vue de définir l'objectif et les domaines à couvrir par un programme approprié. Il en décrit la méthodologie à l'aide d'un exemple d'actualité. Il fournit un processus informel de formation au jour le jour pouvant avoir lieu au bureau d'études. Il termine enfin son exposé en examinant les problèmes essentiels de gestion.

### **ZUSAMMENFASSUNG**

Der Verfasser diskutiert die Notwendigkeit für Fortbildung im Bauingenieurwesen im Ingenieurbüro. Dazu wird ein zweckmassiges Programm vorgeschlagen, und die Gebiete, die es umschliessen soll, werden definiert. Die Methodologie wird an Hand eines praktischen Beispiels beschrieben. Informelle Ausbildung, die während der normalen Tagesarbeit im Büro stattfinden kann, wird erwähnt. Zum Schluss werden die wesentlichen Management-probleme diskutiert.



## 1. INTRODUCTION :

A young civil engineer in India fresh from an academic institution joins a typical design office in the country at an age of twentythree to twentyfive. He is initially asked to assist a senior level engineer in the project that he is handling, and is expected to learn things on the job itself. In his spare time, he can read available technical literature. Site visits would be possible after a couple of years of work. After another five years, depending upon performance, he would get some level of managerial responsibility. Such process of career growth would continue till the end of the individual's working life with the organisation.

This situation prevailed till about 1980. Subsequently, the pattern needed a change because of advance of technology and increased competition. The use of personal and mini computers in civil engineering analysis and design increased substantially. Secondly, newer and more sophisticated construction techniques were adopted on many projects carried out in the country. Thirdly, an ambitious young engineer entering the job market found it necessary to get some exposure to the principles and practise of management. There was therefore a sort of information explosion, which the individual sometimes found difficult to manage within his constraints.

It was then realised that a design office or organisation could play an active role in offering its young engineers a reasonable level of additional educational opportunities using its own human and other resources. As a return on this investment, it was likely to get people with a drive and equipped with the skills to make a greater contribution to the organisation's work effort, production and profits. Some amount of formal training is required for this purpose, and it should follow a carefully worked out plan.

## 2. PROGRAMME PLANNING :

If the organisation has a human resources development department, it can become the prime mover of the training activity. The starting point of the planning process is a clear definition of the organisation's objectives in building up its engineering cadre and the technical and managerial skills it expects from it within a certain period of time.

The next step is to demarcate the areas that are to be covered in the training programme. For each area, a detailed chart of activities can be prepared. The faculty and other assisting staff can be finally nominated after ensuring their availability and willingness to spare the time required for the purpose.

The basic idea of providing training facilities to the staff needs to be approved by the chief executive of the organisation before the planning process begins. After the costs are worked out, the budgetary sanctions can be obtained. The author thought it necessary to mention these things for the sake of completeness.

### 3. SUBJECTS TO BE CONSIDERED :'

When the design office is a part of a larger construction organisation, like in the author's case, the following list of themes may be proposed :

#### 3.1 Bidding for national and international projects

Marketing is the basic activity for the sustinance and growth of the construction business. The young engineer must gradually become familiar with the company's systems and procedures for bidding, and the choice of strategy according to the prevalent market conditions.

#### 3.2 Analysis, design and drafting

These are the bread and butter work activities of the design office, and the engineer will deal with them everyday. He would probably be keen to know to what extent computer hardware and software can be used in his work environment.

#### 3.3 Design and detailing - special issues

There would always be some special issues to which the office might like the engineer to pay special attention. These might be, for example, design to meet servicability criteria, stress corrosion in tensioned cables, detailing of joints in precast concrete construction, or foundation settlement problems. Through case studies such points can be illustrated.

#### 3.4 Construction techniques and plant

A budding designer must have some idea of how temporary structures can be conceived and appropriate schemes worked out to realise the main structure at the job site. He must also know what kind of plant is available for this purpose.

#### 3.5 Project Management

The project managers at construction sites can come to the design office and from their experience highlight for the engineers the important points to note in order to achieve the planned rate of progress and cost economies in construction at site. Information on monitoring systems will also be useful.

#### 3.6 Construction in harmony with the environment

The civil engineer must be made aware of the individual and social responsibilities about this important issue. Man builds to satisfy his needs and to fulfil his higher aspirations. This should be achieved while maintaining a proper balance with the environment. Reckless commercialism tends to ignore this factor resulting in ecological disasters. For this reason there are controversies about some hydel and other projects in India.

Engineers should also try to develop an aesthetic sensitivity and aim to design structures which will blend easily with the environment. For inspiration they can see some beautiful temples built in India many centuries ago.



#### 4. METHODOLOGY :

After the program has been outlined as described earlier, the methodology of training can be worked out. The main thrust should be on the proper collection and dissemination of information. It can be in the form of sharing one's practical experience and first hand knowledge of things, or by way of communication, clarification and elucidation of the subject after one has studied it from published literature or any other open channel of knowledge.

The training programmes can be of short (one day) to medium (three days) duration. Alternatively, they can be stretched over a longer period of about two weeks with lecture and tutorial sessions of sixty to ninety minutes per day. The program logistics in the form of preparation and timely distribution of the course material, selection of venue etc. should receive proper attention.

As far as the faculty is concerned, it is possible to locate within the organisation two kinds of people amongst the senior staff. The first may usually deal with problems involving some amount of mathematical or other kind of theoretical complexity. Others may possess greater skills in some specialised areas of project work. Both of them can cover different sides of the organisation's training activities, if they possess proper communication skills to make the presentations effective.

The batches of trainees should be small, limited to about ten to twelve in a group. Audience participation should be encouraged through question and answer sessions, discussions and exercises.

These days, apart from the normal audiovisual aids, it is possible to use PC's for computer aided learning or videocassettes for the sake of presentations. If conditions permit, these techniques can be profitably utilised.

#### 5. A PRACTICAL EXAMPLE :

The author of this paper had the opportunity to organise three training programs in his Company in 1990. Two of them are mentioned here. The first course was in the computer language Fortran - 77, and the other in matrix methods in static and dynamic structural analysis. Both the programs consisted of ninety minute lecture sessions every day during working hours spread over a period of two weeks. About fifteen engineers attended each of the courses.

The emphasis was on practical application. Appropriate examples from the design office were chosen to illustrate the points discussed in the lectures. The course on matrix methods was planned to bring out what goes on behind the graphic displays in software packages. The engineers were told why it is necessary to avoid using the computer blindly in a routine and mechanical manner. As far as could be judged from the feedbacks of the participants, the aims and objectives of the courses seemed to have been achieved.

The important point to note in this activity was that the facility was provided to the engineers in their familiar office environment. They indicated their preference for this arrangement as against expensive visits to seminars held in luxury hotels outside.

#### 6. INFORMAL EDUCATION :

A process of informal education goes on in the dialogues between the junior and senior level engineers in the day to day design activity. As long as the will to communicate and to share is present, these exchanges contribute a lot towards better understanding of the real life situation with its problems, and to evolve solutions.

The issues involved could be either technical or commercial. Sometimes a governing design code may be a little vague according to the wording of a particular clause. A proper interpretation is then required. The senior person can provide it. Similarly a clause in a contract document may give rise to some controversy between the owner and his consultant and the designer. In this case also the guidance of the senior person could be very valuable to the younger one.

In the detailing of reinforced concrete and other structures too, many problems demand a creative solution which require quite a bit of thinking from all. Here the trialogue between the senior and junior engineers and the draughtsman leads to a satisfactory result. The drawing board is always a happy place for a fruitful discussion. The introduction of computer aided drafting in its place will only change the technique of discussion, and various solution alternatives could be worked out speedily.

An engineer naturally learns many things at a construction site too. A discussion on this point will however require a separate article, and is therefore not presently attempted.

#### 7. MANAGEMENT ISSUES :

There is no doubt today that a young civil engineer needs to develop an awareness of the basic management principles and the issues that need to be addressed in the organisation for which he works. There is a severe resources crunch in the developing countries, and cost and time overruns on construction projects can have very serious implications.

The young entrant to the organisation needs to understand the whole gamut of problems involved. He can be helped in the process, if the firm gives him some amount of exposure on the issues involved. These could be broadly defined as follows -

- a) Awareness of the corporate objectives,
- b) Improvement in productivity and effectiveness,
- c) Better team spirit and work relationships,
- d) Professionalism and cost consciousness,
- e) Timely completion of projects,



- f) Project finance management, and
- g) The decision making process.

A suitable three to four day program could be prepared by the training wing of the company which will cover the points mentioned above. The faculty can be a mix of in-house and guest speakers. The company leadership can contribute to the individual's sense of involvement with the organisation by sharing its views and experiences with him.

#### 8. PERSPECTIVE WIDENING :

The civil engineer does not work in a society in isolation, and should therefore consciously strive to keep its broader issues before his mind. In this effort he could get guidance from the work of national and international leaders of the profession. As an example, the author would like to mention the very significant contribution of Prof.Dr.Jörg Schleich of Germany by his articles on the energy crisis facing mankind and its possible solutions. Some of them were published by IABSE in the past.

#### 9. CONCLUSION :

Engineering education is a lifelong process for the individual. The design office and the organisation for which he works can make a meaningful contribution to it. The idea is not to spoonfeed him with readymade work formulas but to promote his initiative and creative spirit which may otherwise lie dormant.

The additional effort required on the part of the company executives may be substantial. However, on account of their contribution, the cost would be less than that of any other alternative. Ultimately they will create assets for the organisation in the form of quality and cost conscious young engineers with a markedly professional outlook.

In this article the author has tried to share his ideas and experiences of a particular Indian environment with fellow members of the IABSE fraternity. He looks forward to receive their views when an opportunity for discussion becomes available.

#### 10. ACKNOWLEDGEMENTS :

The author is grateful to Mr. Abhijit Rajan, Managing Director of his Company, for the permission and encouragement to publish the paper. He also thanks the senior and junior colleagues in his organisation. The discussions with them have contributed to the thought process behind writing the article.

### **Objectives of Continuing Engineering Education in Libya**

Objectifs de la formation permanente des ingénieurs civils en Libye

Ziele einer weiterführenden Ingenieurausbildung in Lybien

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#### **SUMMARY**

This paper describes the needs, objectives and the various methods of implementing engineering continuing education programs in Libya and that of motivating the engineers to update and advance their technical knowledge to face the challenges of the modern world. Recommendations are made to organise scientific teams on a continuous basis, between industry, research centers and universities, for achieving results which will have a positive impact on the country's development.

#### **RÉSUMÉ**

L'article présente les besoins, les objectifs et les diverses méthodes d'application des programmes de formation permanente des ingénieurs libyens, ainsi que les motivations de ces derniers pour poursuivre et parfaire leurs connaissances techniques face à la compétition mondiale actuelle. Il indique également les recommandations prévues pour organiser des équipes scientifiques, d'efficience continue, composées de spécialistes de l'industrie, des centres de recherche et des universités, en vue de parvenir à des résultats concrets ayant un impact positif sur le développement du pays.

#### **ZUSAMMENFASSUNG**

Der Aufsatz beschreibt die Anforderungen, Ziele und verschiedenen Methoden der Einrichtung von Weiterbildungsprogrammen für Ingenieure in Libyen. Es geht um ihre Motivierung, ihr Wissen aufzufrischen, zu erweitern und sich den Herausforderungen der modernen Welt zu stellen. Es wird empfohlen, permanente Teams von Wissenschaftlern aus Industrie, Forschungszentren und Universitäten zusammenzustellen, um für die Landesentwicklung positive Ergebnisse zu erreichen.



## 1. INTRODUCTION

First degree engineering education curriculum at a university or at a technical institute is meant to introduce principles of engineering science followed by their applications in various disciplines of engineering and leading ultimately to a specialised branch of career engineering. A fresh engineering graduate possesses all the technical ingredients and is ready for moulding into a professional engineer. His engineering career starts in the industry where he is faced with real problems which make him think to apply his classroom knowledge to solve some of the field problems. He begins to learn the techniques of the trade from his supervisors. Surrounded by rapidly developing industrial environments he finds himself lost with his present academic background. Very soon he realises a need for more information, more practical training and more knowledge to adopt to the challenges of the industry. He feels the necessity of engineering continuing education (ECE) program to keep himself upto date and abreast with the latest technical and innovative developments of the industry.

To-day's new graduate engineers are better grounded technically, know more theory and are more analytically inclined than their predecessors. These "old" engineers need to be exposed to new methods of computer aided analysis and design, rapid advances in materials and construction processes, communication, environment, energy conversion and electrical sensing and measurements. The goal of keeping these engineers well informed and upto date is by launching well planned programs of ECE.

The need for starting ECE programs is felt much more in third world countries where most of the sophisticated industries set up by importing advanced technology from developed countries demand creative and skilled designers and supervisors which the local engineering education curriculum cannot provide. Libya is suffering from same sort of situation. Technical universities and higher technical institutes in the country are mainly geared towards turning out engineering graduates with a B.Sc. degree who are not capable of managing highly sophisticated industries like steel plants, refineries, cement plants and many other important factories. So the need and importance of ECE programs to train and further educate the Libyan engineers cannot be over emphasized.

## 2. OBJECTIVES OF CONTINUING EDUCATION

Infrastructure of modern industrial society in this competitive world demands computer orientation, automation and artificial intelligence, utilisation of new sources of energy, discovering of new materials and their construction processes, fast modes of transportation, space technology, communication systems, onland and offshore exploration, microbiological studies and management skills. It is not possible to cover all these aspects in the engineering curriculum. Exposure of engineers to these innovative ideas is the main objective of ECE programs so that these engineers become the part of national asset of the country. Further development of engineering sciences is a continuous

process. Continuing education programs support the concept of "AS LONG AS I LIVE SO LONG DO I LEARN" (1).

### 3. PROGRAMS OF CONTINUING EDUCATION

ECE programs for developing countries like Libya have to be specially tailored to produce well trained and well informed skilled type of engineers responsible for supervision, maintenance and management, whereas in developed countries the main objective of continuing education is to cater for two types of engineers, creative engineers responsible for research and development and skilled engineers responsible for operation, supervision and management. It is the intention of this paper to focus more attention on ECE programs for engineers in developing countries. This objective can be achieved through:

1. Short term refresher courses to be organised by university in collaboration with industry.
2. Workshops organised by Training Institutes and Industries to introduce new construction and manufacture processes.
3. Seminars and Symposiums.
4. Participation in National and International conferences.
5. Visits to universities and research centers.
6. Higher education.
7. Exchange programs between industry and universities.
8. Activities of the engineering societies.
9. Lectures by guest speakers.
10. Visits to site and factories in the country and abroad.
11. Tailored training programs for a group of engineers, and
12. Technical collaboration with engineering societies of developed countries.

Further special programs of ECE have to be planned for executives and planners. They require exposition to latest techniques of management, socio-economic problems and environmental sciences in addition to their own field of specialisation.

### 4. IMPLEMENTATION OF ECE PROGRAMS IN LIBYA

Although need and objectives of ECE programs are clear in the minds of planners in this country but implementation of these programs has certain restraints. A short introduction to the engineering education system in Libya is necessary before



embarking upon the mechanism of implementing ECE programs in the country.

Engineering education in Libya started from the fall of 1961 with an enrolment of 13 students in the engineering college set up with the aid of UNESCO. Later in 1967, this college became the faculty of engineering as part of the University of Libya established in 1957 which lately came to be known as the University of Al Fateh. At a later time another faculty of engineering was set up within the University of Gar Younis in Benghazi. In addition to these universities, many other higher technical institutes were started in different parts of the country during seventies and eighties. Recently a university at Sebha has also been started which has a school of engineering affiliated to it. Postgraduate programs offering higher diploma were started at AL Fateh University back in 1974 which was replaced by an M.Sc. program in 1976. These postgraduate programs have not been so successful due to lack of students since the demand of engineers in the industry is much more than the supply due to country's many ambitious development plans being executed simultaneously.

It can be seen from the list of various modes of conducting ECE programs, the role of universities is very important and they can help in collaboration with industry to organise refresher courses, workshops, seminars, symposiums, exchange programs and higher study courses. But so far it has not been fully possible to achieve this goal. Main reasons attributed to this partial success are lack of organisation and motivation, lack of financial support from higher authorities, lack of laboratory equipment and research facilities, social constraints and missing of a link between industry and the university. Since the universities are traditionally the place for most research, and industry necessarily the place for more technology, what is required is more interaction between the two. The level of productive cooperation between industry and universities is low because of mutual underestimation, that is, practicing engineers believe that university professors are more academic and are not aware of the problems and challenges of industrial research. This concept has led the practicing engineers not making full use of ECE programs organised by universities in Libya from time to time. Another reason of small attendance of engineers to these courses is fear of having forgotten their theoretical background.

To encourage ECE programs, a scientific society of engineers (SSE) was established in Tripoli in 1978. The main objectives of this society are to arrange lectures by invited experts, organise seminars and symposiums in different fields of applied science and engineering, organise technical visits for a group of engineers and to encourage some interaction among engineers and other members of the society. The society has 400 members. Unfortunately the attendance to weekly guest lectures is very poor. The spread of practicing engineers all over the country, the existence of a wide gap among industry, universities, research centers and SSE are some of the main reasons for poor attendance.

The experience so far mentioned has not been promising, and so new means of implementation of ECE programs are required to be planned for Libya. Creation of local chapters of SSE in different parts of

the country and improving interaction between industry and engineering educators by organising refresher courses, workshops and seminars in different industrial centers may be the answer. In addition, technical collaboration with engineering societies of developed countries can be used to provide guest speakers and means to upgrade ECE programs from time to time, and can be a source of interaction for providing management and industrial training, and mutual contacts for organising refresher courses, seminars and conferences.

## 5. RECOMMENDATIONS

To meet the growing demands of modern Industries the updating of engineers through well organised ECE programs is essential. Such programs have to be specially planned for oil rich developing countries like Libya where motivation among engineers is lacking due to absence of competition in the employment market. Efforts are required to reach the engineers and provide them incentives and easy access to ECE programs.

Objectives of ECE programs can be achieved by:

1. Providing promotion incentive to motivated and deserving engineers.
2. Setting up local chapters of SSE in different parts of the country and organising weekly meetings.
3. Improving interaction between Industry and educational institutes by organising workshops, refresher courses and seminars at industrial centres and universities.
4. Providing scholarships to engineers to pursue higher studies in their field of interest.
5. Setting up industrial training and research centres.
6. Technical collaboration with engineering societies of developed countries which can provide guest speakers, opportunities for industrial training and technical visits abroad.

It is also recommended that the best means of implementing ECE programs in developing countries is to set up an agency at national level to plan and organise ECE programs for engineers to enhance the economic and industrial development of the country and keeping abreast with the new scientific and technical developments of the industrial world.



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## Continuing Education of Bridge Engineers in Poland

Formation permanente des ingénieurs des ponts en Polonie

Kontinuierliche Schulung der Brückenbauingenieure in Polen

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### SUMMARY

The education of civil engineers has been pursued on at the Wrocław Technical University (WTU) for many years. The fundamental educational task is undergraduate study, which consists of two parts: a 3-year basic part and 2-years specialization. The paper also presents other forms for continuing education of bridge engineers.

### RÉSUMÉ

L'Ecole Polytechnique de Wrocław forme des ingénieurs civils spécialisés dans la construction de ponts depuis de nombreuses années. Les études comportent la formation de base d'une durée de trois années jusqu'au premier diplôme, suivie d'une spécialisation de deux années. L'article donne en outre les autres formes de formation continue et de perfectionnement prévus pour les ingénieurs des ponts.

### ZUSAMMENFASSUNG

Seit vielen Jahren sind an der Technischen Universität Wrocław Bauingenieure, die sich im Brückenbau spezialisieren, geschult worden. Die grundlegende Bildungsaufgabe ist die Zeit bis zum ersten Diplom, die sich aus dem dreijährigen Basisteil und der zweijährigen Spezialisierung zusammensetzt. Der Artikel gibt außerdem andere Formen der kontinuierlichen Weiterbildung für Brückenbauingenieure an.



## 1. INTRODUCTION

The Wrocław Technical University is one of the largest technical universities in Poland. Today it employs some 6500 personnel, including nearly 2000 faculty members: cca. 350 full rank professors, 1350 lecturers and assistant professors, 270 instructors, as well as 180 teachers of physical education, foreign languages, etc.

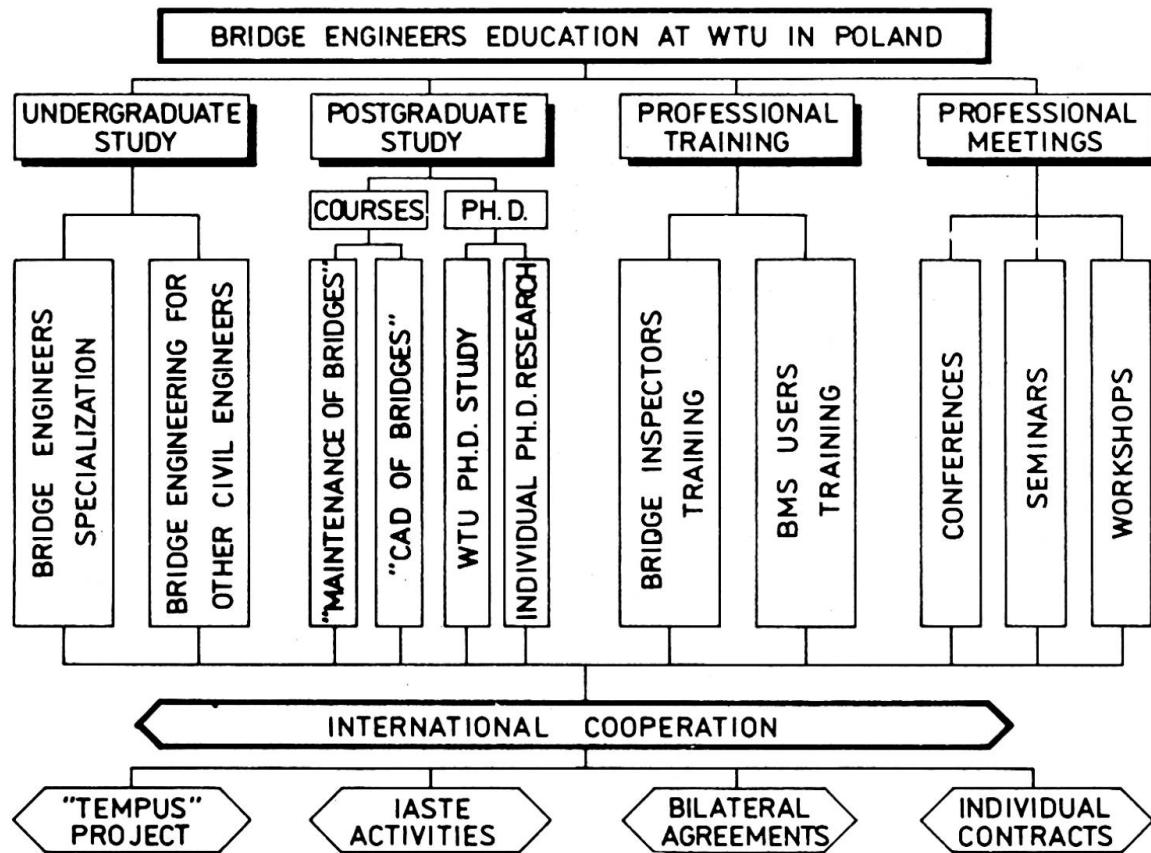
Annually, about 1200 incoming students are enrolled to 11 faculties, making the total number of the University undergraduates around 6500.

The University has a sound physical layout: 195 buildings with a total area of 327000 sqm including several hundred laboratories and workshops. All students of the University have access to terminals at the Computer Center.

The University Library System, consisting of the main library and several specialized Faculty, Institute and Interinstitute Libraries, has developed considerably. Its holdings consist of approximately 550000 books, 115000 magazines (with 573 titles), and 602000 special pieces (maps, microfilms, standards).

Students at the WTU are educated in 20 broad disciplines and are able to choose from among dozens of specializations.

The education of bridge engineers is carried on by the Bridge Group of the Institute of civil Engineering. In the Group 12 faculties and 4 technical workers are employed. During last ten years the

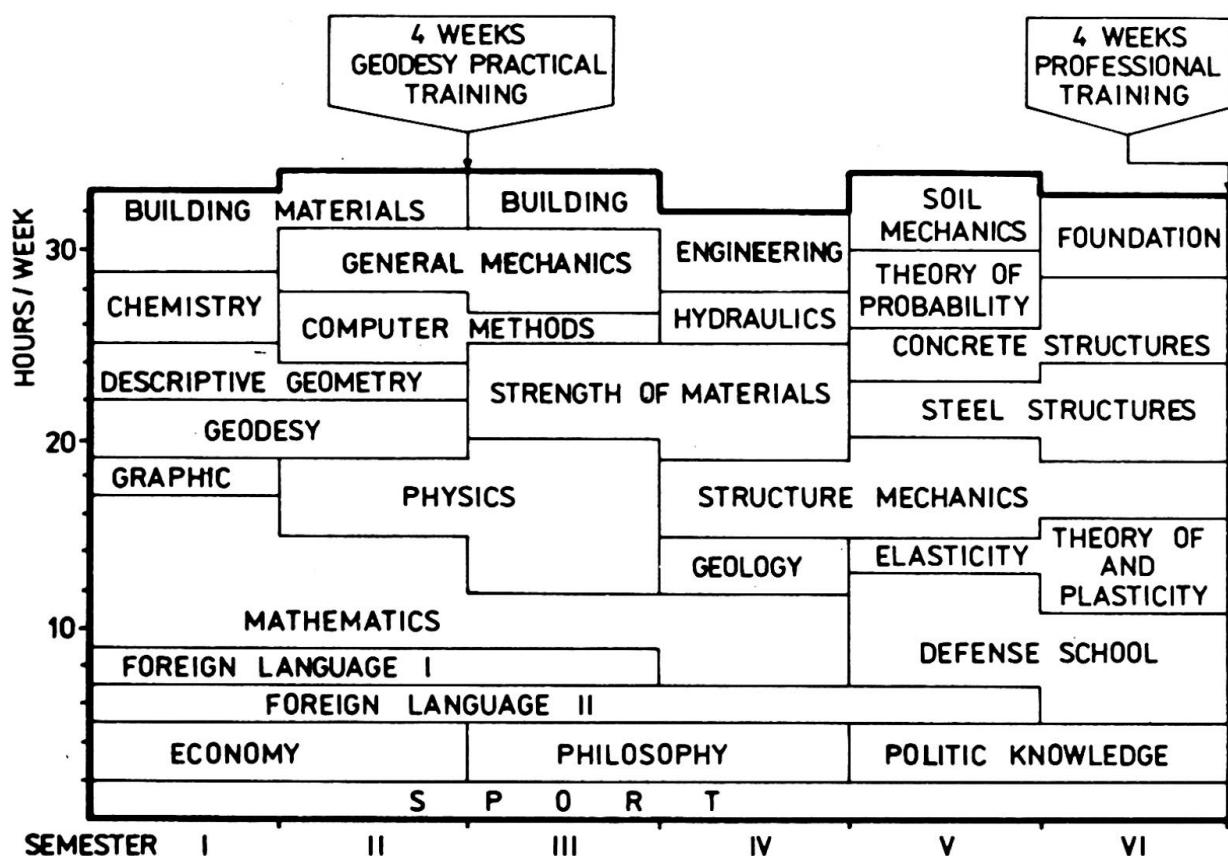


**Fig.1** Scheme of continuing education of bridge engineers at Wrocław Technical University.

special programme of the continuing education of bridge engineers has been elaborated and implemented. This programme is realized in several forms presented in Fig.1. In 1991 about 120 undergraduate students and some of 90 bridge engineers have been taken a part in all forms of bridge engineering education.

## 2. UNDERGRADUATE STUDY

The undergraduate study is the main field of educational activity of the University. There are two periods of study in each curriculum. The first period lasts for semesters and is interdisciplinary in character. All students are required to attend this general segment of their education in a rigid manner. It consists of coursework in the so called basic theoretical subjects (mathematics, physics, and in some cases chemistry); general technical subjects like engineering graphics, computer science, courses in foreign languages, social sciences, physical education and few electives in a student's proposed field of specialization. Thus the student has an opportunity to broaden himself intellectually as well as to pursue individual interests. The frame programme of the general education of bridge engineers (first 3 years) is presented in Fig.2.



**Fig.2** Programme of general part of bridge engineers education at WTU

The second period of study, called specialized education, continues through semesters VII-IX. Curricula for this period are specified



for each specialization, but are set up by the Faculty Council in form of a general schedule for each specialization. Only few electives are possible.

The last, 10th semester is designed for preparing the master thesis, whose topic is drawn up and given to the student following his completion of eight credited semesters. The preliminary work for the thesis may be done for credit starting at 8th semester in the independent study programmes. In this programmes students solve original technical problems and are under individual supervision of a staff members. Problems are presented so as to take advantage of the entire theoretical and methodological corpus acquired by the student during his earlier years of study.

Education in Bridge Engineering is carried on two ranges:

- comprehensive, for bridge engineers,
- limited, for civil engineers of other specialization (see Fig.1).

The programme of bridge engineers specialization (last 2 years) is presented in Fig.3.

Majority of graduates leave the university and seek a job in the industry at the technical management or research/development positions (engineers). Some of them enter the graduate school and work in the University Institutes on their Ph.D. for additional 3-4 years.

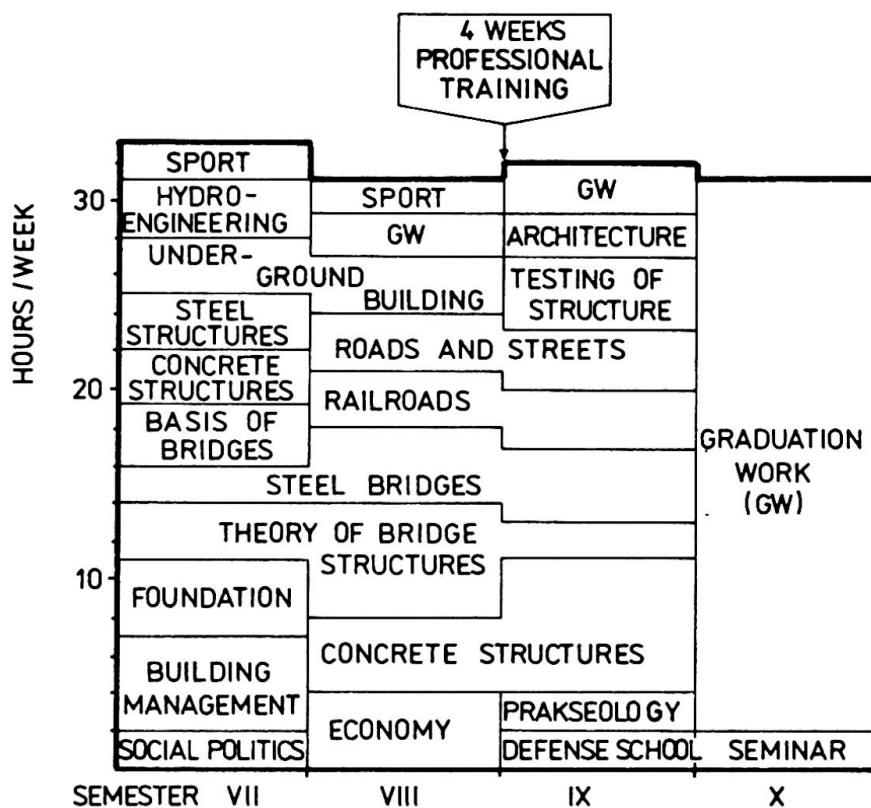
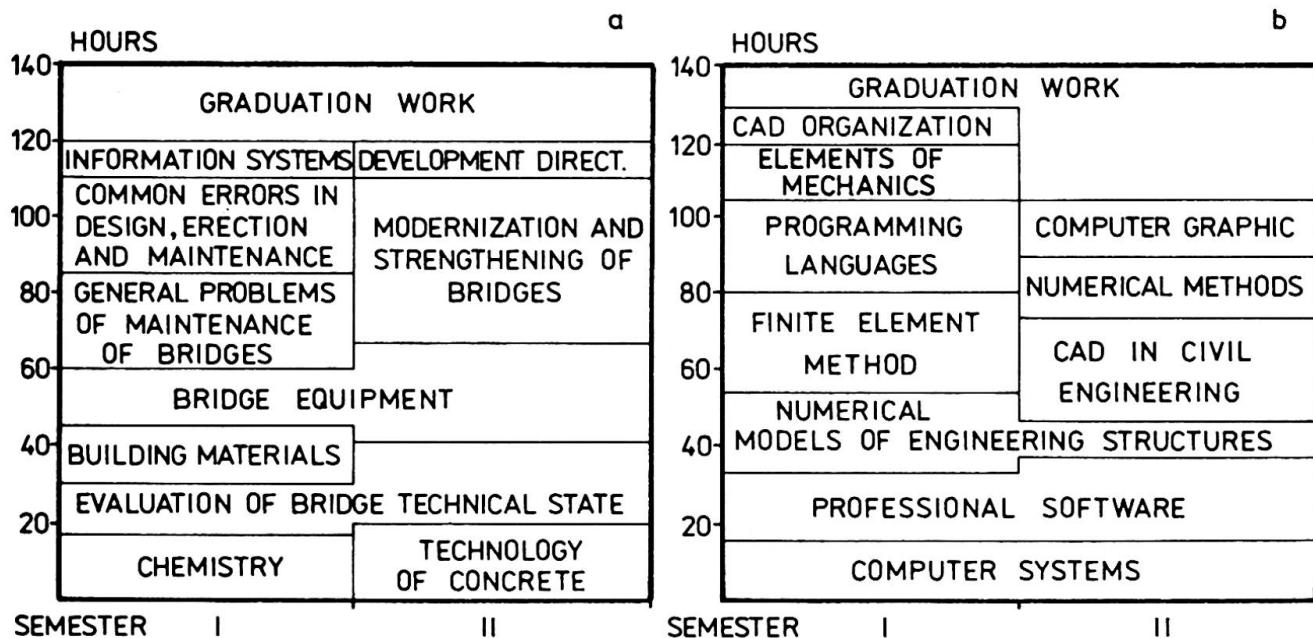


Fig.3 Programme of specialization of bridge engineers at WTU

### 3. POSTGRADUATE STUDY AND PROFESSIONAL TRAINING/MEETINGS

Three main forms of continuing education of bridge engineers are carried on at the WTU: postgraduate study, professional training and professional meetings.

Two kinds of postgraduate study can be distinguished: postgraduate courses and Ph.D. study. At present two annual courses are carried on: "Maintenance of Bridges" for engineers employed in both the Public Road Administration and the Railway Administration and "Computer Aided Design of Bridges" for bridge designers. The frame programmes of the courses are presented in Fig.4.



**Fig.4** Programmes of postgraduate courses: (a) - "Maintenance of Bridges", (b) - "Computer Aided Design of Bridges".

The Ph.D. thesis can be completed during special Ph.D. study organized by the WTU or as a individual research work.

Short-term (3-4 weeks) professional training is dedicated to bridge inspectors ("Bridge Inspectors Training") and to managers from road administration ("Bridge Management System Users Training") who are implementing the computer BMS developed with the WTU Bridge Group participation.

Professional meetings (conferences, seminars, workshops) are organized periodically (e.g. International Conference "Safety of Bridge Structures", National Conference "Short-Span Bridges Problems") or incidentally. Two to three meetings are organized every year.

#### 4. INTERNATIONAL COOPERATION

Civil Engineering education is facing several challenges. The practice of engineering has evolved to large firms conducting multi-national projects in many countries and cultures. To be contemporary, graduates need to be internationally competent in the practice of civil engineering. Typical curriculum does not provide international skills. The teaching of the practice of engineering has been diminished by introduction of science, theory and extensive computer capability and discarding of previously taught



practical skills. Overhaul is difficult within accreditation constrains on curriculum content. The graduates are not meeting the expectations of industry. European Civil Engineering curricula have a strong practical focus which complements the U.S. needs.

The Institute of Civil Engineering of the W TU has three direct cooperation agreements with the counterpart institutes in :

- the Delft University of Technology in the Netherlands,
- the University of Nevada-Reno in USA,
- the Colorado State University.- Fort Collins in U.S.A..

On the basis of these cooperation some programs of joint educations in bridge engineering are created. They are submitted as well to the TEMPUS project as to the National Science Foundation and FIPSE project of U.S. Ministry of Education. The idea of continuing education in bridge engineering may be proposed within these projects. The International School for Bridge Engineering is the idea for focusing of individual efforts, experiences of different institutions and universities policy for improvement of education in Civil Engineering. The School activity would occur in several forms:

- exchange of video tapes (with subject concerning bridge engineering elaborated by each cooperating institutions ) between associated by the School participants,
- seminars with invited lectures,
- lecture course for undergraduates and postgraduates,
- practical training,
- joint research and design project, etc.

Realization of this plan needs some funds which will be searching after general agreement between participants. The role of IABSE and other international associations is helping with the program of the School and assistance with its implementation.

## Distance Learning Mode of Study in Construction Management

Mode d'enseignement à distance en gestion des constructions

Fernstudium für Baumanagement

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Tim Bilham, MA. Director of Continuing Education. Project Manager for the Distance Learning M.Sc. A graduate of Cambridge University in Mathematics and Engineering Science, has vast experience in adult education. A consultant to the BBC and through the Open University has 'taught at a distance' both in the UK and overseas.

### SUMMARY

This paper discusses the development of a distance learning mode of study to supplement an existing full time and part time course in Construction Management. Academic issues, organisational issues, institutional issues and personal issues are addressed. Reasons for developing distance learning are explained and the mechanisms adopted are noted. Many lessons have been learned by all concerned. The course is an academic success and is projected to be a significant financial success too. As for any novel venture, the difficulties were considerable but so was the excitement, commitment and potential rewards.

### RÉSUMÉ

Cet article examine le développement d'un mode d'enseignement à distance, venant compléter un cours existant à temps plein et partiel dans le domaine de la gestion des constructions. L'auteur y examine des problèmes d'ordre académique, organisationnel, institutionnel et personnel. Il fournit les raisons de la mise au point d'un tel mode d'enseignement à distance et des mécanismes à adopter dans ce sens. Tous les intéressés (professeurs, étudiants etc.) de ce cours ont su en tirer des leçons et ont participé à la maîtrise de nombreuses difficultés. Ce cours s'avère être un succès au niveau de l'enseignement et il semble voué à être également un succès financier.

### ZUSAMMENFASSUNG

Bereits existierende Voll- und Teilzeitstudiengänge zum Master of Science im Baumanagement sollen durch einen Fernstudiengang erweitert werden. Akademische, organisatorische, institutionelle und personelle Belange werden ausgesprochen. Erklärt werden die Gründe und die Mechanismen, die zur Entwicklung des Studiengangs führten, wobei alle Beteiligten manches zu lernen hatten. Der Studiengang ist nicht nur ein akademischer Erfolg, sondern verspricht auch finanziell einer zu werden. Die Schwierigkeiten waren beträchtlich — wie bei allen neuen Unternehmungen — aber ebenso die Herausforderung, die Hingabe an die Sache und das mögliche Erfolgserlebnis.



### 1. INTRODUCTION

Whilst working at Brunel University in West London, the three academics who now comprise the Construction Study Unit (CSU) developed an MSc course in Construction Management. The course has attracted some 20 full time students and around 8 part-time students per year.

Following financial pressures on British Universities during the early 1980s, the University Grants Committee (now University Funding Committee - UFC) agreed to effect the transfer of the academic staff of the CSU to the University of Bath; this transfer took place in October 1987.

However, the market for conventional full time and part-time MSc courses was becoming increasingly competitive and the normal sources of funding for major research activities were subject to quite severe financial cutbacks.

Discussions and analyses of education needs, opportunities and available programmes at postgraduate level in the construction industry showed that MBAs were popular and major competitors of Construction Management MScs. Fortunately, the nature of the Bath MSc was similar to an MBA course but within the contextual requirements of the construction industry; several graduates had labelled the course, "The MBA for the construction industry".

As the industry has a tradition of day-release and short block-release, so that people can maintain full time productive employment whilst undertaking education to obtain higher qualifications, it seemed clear that extension of the existing MSc course into the distance learning mode of study was appropriate and desirable. That members of the Centre for Continuing Education (CCE) at the University of Bath had experience of preparing distance learning study materials, through working with the Open University, was a real bonus.

### 2. INITIAL DEVELOPMENTS

As an initial market investigation, a "corner-flash" was added to the advertisements placed in January 1988 for the MSc by full time and part-time study indicating that distance learning was to be launched. Within a few weeks some 425 enquiries had been made of, which one third were from overseas. Clearly, there was a large potential market.

Fortunately, the UFC was seeking to promote new developments in the field of continuing education. An application for financial support to develop the distance learning version of the course was successful; £20,000 was obtained for the year 1988/89 and a further £30,000 for the year 1989/90. Part of that funding was earmarked for the training of staff, both academic and administrative; to enable academics to investigate and acquire skills to produce materials suitable for the special learning needs of distance learning students and to aid the administrative staff in setting up and operating the extensive and complex systems needed to ensure the proper operation of the course.

### 3. ACADEMIC ACCEPTANCE

As this course was the first of its kind at the University of Bath, it set many precedents and constituted an academic "trail blazer". Consequently, it was

subject to much scrutiny by academic boards.

An early problem was convincing members of the School's Board of Studies that it was not merely a "correspondence" course but was an extension of existing academic activities, at a proper postgraduate level. Resistance was exacerbated by the view of certain staff that the School was a design School, that Construction Management was peripheral and that major developments of this nature would dilute the School's main activities. Fortunately, a leading professor lent strong support to the proposal.

An essential element in securing approval by the academic boards was that the proposal comprised the development of a new mode of study for an existing, successful Masters course. That the Scheme of Studies (Syllabus) was in place, that all assessments of students and criteria for passing were to be common across all three modes of study, that entry requirements would be common across the course and that the distance learning mode would incorporate compulsory residential schools at which there would be intensive study through more conventional techniques and close personal contact between the students and staff allayed many fears.

#### 4. ADMINISTRATION ACCEPTANCE

This occurred in tandem with obtaining academic acceptance. The application to develop the distance learning mode revolved around the business plan, produced jointly by CSU and CCE. Analysis of the Scheme of Studies yielded a schedule of the study materials to be produced (see Figure 1). Then, production costs were calculated. A major issue involved the video tapes for the course. Employment of commercial producers of video tapes was costed at £1000-£2000 per minute of video tape - this option was far too expensive! All the workbooks, video tapes and audio tapes were produced in-house.

It was established early that the provision of the distance learning mode was extra to the normal workload for academic staff; in consequence, a schedule of payments was drawn up to reimburse authors, tutors etc for the activities necessary to develop and operate the course.

The business plan was sensitive to student numbers. It was assumed that recruitment would build over 5 years to a steady state, that the normal period of study for each of the 4 taught modules would be 6 months, that the drop out rate would average at 10% per module and that students would produce dissertations in the third year. The business plan was prepared on marginal costs. It indicated that the course would be in deficit for the first 3 years. Taking the UFC grants into account, it would be necessary for the University to underwrite approximately £24,000 for two years. The business plan predicted that the course would break even in its fourth year.

The business plan was presented to the high level planning boards of the University and was accepted by them as the basis on which development of the distance learning mode of study for the MSc could proceed.

#### 5. PRE-REQUISITES

By the time approval for the development of the distance learning mode had been obtained, it was clear that four elements, all fundamental to success, had come together. Those elements were an enthusiastic and highly committed academic staff in CSU, a distance learning expertise and course administration skills in



CCE, a sizeable market and pump-priming money to help fund the initial development. If any of those elements had not been present, it is highly likely that development would have foundered early.

## 6. PROJECT MANAGEMENT

To develop the materials speedily, efficiently and effectively, a Course Team of 5 was established comprising the three academic staff of CSU, the Director and Assistant Director of CCE. Each member assumed responsibility for several functions: CSU 1 - Author, academic course director, chairperson of course team; CSU 2 - Author, admissions, residential schools; CSU 3 - Author, examinations and assessments; CCE 1 - Project Manager, Production Manager, Editor; CCE 2 - Marketing, administration, student support.

Many other issues had to be dealt with by course team meetings, by individuals or by engaging an outside expert. Generally the arrangements worked very well.

Although many facets of the course were modelled on the Open University (OU) there were and fundamental differences. All members of the course team were involved in the distance learning project in addition to their normal responsibilities. Such part-time involvement put people under great pressure; especially to meet deadlines. As none of the authors had experience in preparing distance learning materials, it was necessary for them to undertake training; use of experienced editors, and the phasing of production eased the problem considerably. Further expertise had to be mastered in other media - video tapes and audio tapes. Early recruitment of students and commencement of the course was essential to provide cash flow for development of further course materials as well as securing a leading place in the market. The lack of any distance learning courses within the University, meant that every aspect of the project set a precedent.

## 7. PRINCIPLES

From the inception, the course team adopted principles which it held paramount. Adherence to those principles has been very difficult on occasions due to numerous changes which have taken place.

- Quality is paramount - both academic and presentational
- Entry requirements for the course are common across all modes of study
- All assessments and criteria for passing are common - assignments, . case studies and examinations
- Attendance at the residential components is compulsory
- All students taking the course by whatever mode of study and in whatever country should be afforded the same opportunities and have equivalent support mechanisms available
- The course fee must be at a competitive level but the major factor to distinguish the course from others is quality

## 8. COURSE STRUCTURE

The course structure is shown in Figure 1. Students are required to study and pass the 4 taught modules (Management Principles - MT, Management Science - MS, Construction Economics - CE and Management Practice - MP) and the module

comprising 4 case studies (one of which relates to each taught module) before being permitted to proceed to the dissertation stage. The University requires also that the residential requirement be met prior to the award of the degree.

\* **4 CASE STUDIES:** One associated with each taught module

**MANAGEMENT SCIENCE**

MS1 Operations Research  
MS2 Statistics  
MS3 Information Management

3 Videos  
1 Audio Package

**ENTRY (Video)****MANAGEMENT PRINCIPLES**

MT1 Macro  
MT2 Advanced Techniques  
MT3 Micro  
MT4 Corporate Techniques

2 Videos

**CONSTRUCTION ECONOMICS**

CE1 Economic Environment  
CE2 Construction Economics  
CE3 Investment and Finance

3 Videos

**MANAGEMENT PRACTICE**

MP1 Human Resources Management  
MP2 Legal Aspects  
MP3 Construction Practice  
MP4 Design Management

2 Audio Tapes

**DISSERTATION (VIDEO)****MSc DEGREE**

\* **RESIDENTIAL SCHOOLS:** 1 week for each taught module

Fig. 1 Course Structure and Study Materials

Each taught module contains the following study materials:

- Workbooks (1 per unit, hence 3 or 4 per module)
- Textbooks (supplied to supplement, and referenced from, the workbooks)
- Supplementary readings (specialist papers etc, referenced in the workbooks)
- Video tapes
- Audio tapes

Usually, students take the modules consecutively (the order noted above is recommended). Performance in each taught module is considered by the Board of Examiners sequentially therefore, successful students accumulate pass credits for the modules studied as they progress through the course. Having secured a pass credit in each of the 4 taught modules and the case studies module, students are permitted to progress to the dissertation stage; satisfactory completion of which is the final stage in their earning an MSc.

## 9. LOGISTICS AND ADMINISTRATION

All administrative support has been located in CCE in order to focus control and facilitate monitoring.



Amongst the issues requiring particular, continuous attention are:

- Entry twice early - May and November
- Normally students study each taught module consecutively but may change their pace of study or defer for a period provided they complete the course within the 5 year limit
- Dispatching the multitude of course materials
- Ensuring efficient delivery of materials to overseas students, including customs clearance - especially for video tapes
- Organization of residential schools at Bath and overseas (20 per year)
- Establishing, maintaining and monitoring an extensive network of academic tutors
- Receipt of students work for assessment, distribution to academic tutors, receiving marked scripts and returning those to the students with associated distributions of performance records
- A network of personal tutors and provision of counselling-type support
- Securing the production and delivery of all materials on time
- Organizing examinations both at Bath and at overseas centres

#### 10. IMPACT ON THE ORGANIZATION

The production of a distance learning course of the size and scope of the MSc in Construction Management is a major learning process for all concerned:

- Academically it is contributed to a reassessment of the content and structure of the full time and part-time modes of study for the MSc.
- Organizationally it has required the University to amend some of its structures and systems to accommodate study by distance learning.
- Financially it has necessitated reappraisal of what are the implications of a major self-financing degree course.
- Contractually it has required clarification and amendment of the roles of various staff, notably academics (especially copyright issues).
- Professionally it has provided new skills and enhanced the standing of the people concerned.
- Opportunistically it has opened new markets world wide.
- Accessibility it represents a major opportunity for many people to gain a higher degree who, without such a course, would be denied access.

#### 11. CURRENT POSITION

To-date (July 1991) there have been several thousand enquiries about the distance learning mode, several hundred applications and registration of some 120 students. The average drop out rate (people who have ceased to take the course apparently permanently) is around the 10% predicted. Most students taking the course are UK based, around 20% are overseas. The pattern of entry is that around 50 students join in November (both UK and overseas and approaching 20 students (UK only) in May. Thus, the course should achieve "steady state" student numbers in November 1991. Academic success is high - so far no student has failed any module. The external examiner has commented officially to the Vice-Chancellor of the high standards achieved by students taking the course by the distance learning mode of study.

Students from the first intake of the course (November 1989) are completing their final (MP) module and will be embarking on their dissertations in November 1991. Hence, the first distance learning graduates should receive their degrees in 1992.