Continuing education of structural engineers

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Formation continue dans le domaine du génie des structures

Weiterbildung statisch-konstruktiv tätiger Ingenieure

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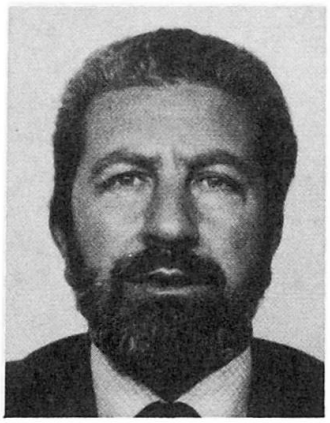

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SUMMARY

An overview is given of the existing activities in Continuing Engineering Education. The aims, contents, methods and organization of Continuing Education of Structural Engineers are then analyzed. The results of a survey carried out in all IABSE national groups are presented and discussed. Some proposals for IABSE policy in the field of Continuing Education of Structural Engineers are formulated.

RÉSUMÉ

La Revue présente un aperçu général des activités existantes dans le domaine de la formation continue pour les ingénieurs des structures, en analysant les buts, les contenus, les méthodes et l'organisation de la formation. Les résultats d'une enquête auprès des Groupes nationaux de l'AIPC sont résumés et discutés. Certaines propositions sont faites en vue d'une future politique de l'Association à l'égard de la formation continue dans le génie des structures.

ZUSAMMENFASSUNG

Es wird ein Überblick über die bestehenden Möglichkeiten zur kontinuierlichen Weiterbildung von Ingenieuren gegeben. Ziele, Inhalte, Methoden und Organisationsformen werden untersucht und die Ergebnisse einer Umfrage, die an alle Nationalen Gruppen der IVBH ging, vorgestellt und diskutiert. Schliesslich werden einige Vorschläge für das zukünftige Verhalten der IVBH formuliert.

1. INTRODUCTION

Continuing Engineering Education does not represent an advanced undergraduate education, but it is a specialized education geared to everyday change in science and technology and the evolution of industry and science as a whole. The term "Continuing Education" therefore means in the present context the further education after the period of studies at University or other equivalent institutions (Fig. 1).

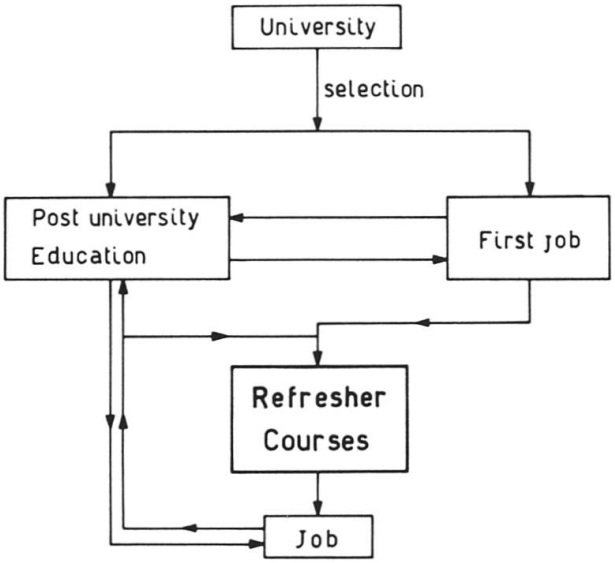

Fig. 1 - Professional education of the engineer

This must serve the purpose of an updating and/or deepening of the graduate knowledge during the engineer's professional life, and must furthermore correspond to a typical need of the individual to acquire new knowledge, to develop new skills for an improvement of his professional position, and to make himself feel an active part of society.

It has been suggested replacing the term "Continuing Education" by "professional development", which includes formal Continuing Education as well as graduate education. We think that "Continuing Education" remains the most significant therm to express the updating in other technical fields. More specifically, as reported in /1/, we can distinguish the following different types of adult engineering education (Fig. 2):

- Degree-oriented engineering education: which means education beyond the undergraduate degree and aimed specifically towards a master's, professional, doctor's or Ph. D. degree.
- Continuing Engineering Education: which means professional technical or management education taken in relatively small doses throughout a career.
- Retraining: which means professional technical education taken in a very large dose (i.e. intensive 6-12 months), possibly once in a career.

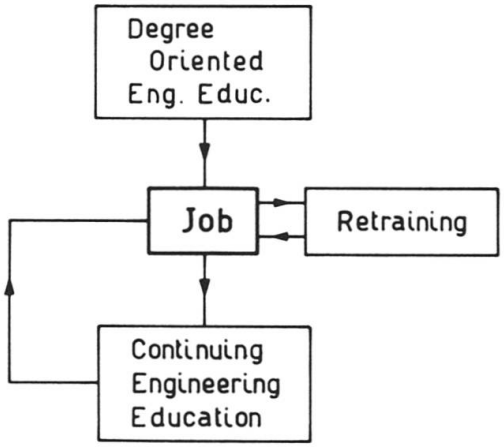

Fig. 2 - Different roles of retraining and CEE

Continuing Education is a major part of a complete educational system and is not simply for a limited period: it must be a lifelong process (Fig. 3) and represent, in a sense, a life style.

CEE plays a role of outstanding importance in the development of an industrialized country. Figure 4 clearly demonstrates the close relationship between the le

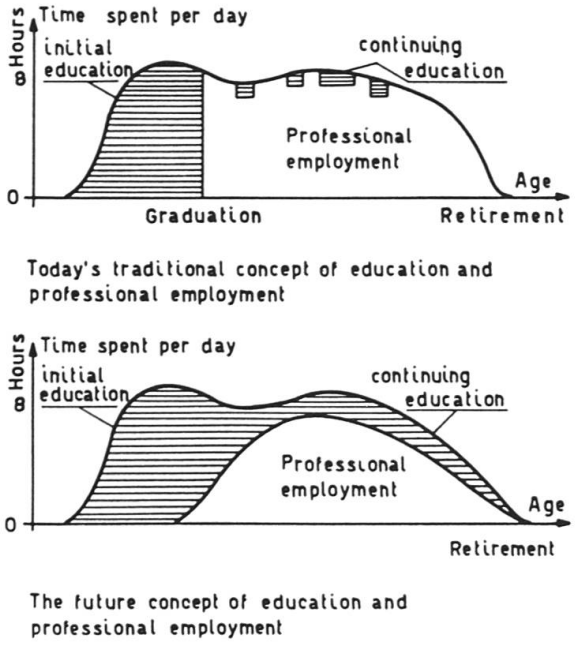

Fig. 3 - CEE as a life long process
Source: N.K. OVESEN /4/

are developed. These courses are therefore tailored to these needs and designed in the three phases shown in Fig. 5 /3/.

2. INTERNATIONAL ORGANIZATION IN CEE

There are several international organizations, spread over the five continents, which are concerned with engineerig and Continuing Engineering Education. In particular, we can mention those shown in Fig. 6.

Furthermore, quite recently an UNESCO International Working Group on Continuing Education of Engineers has been formed (1973) in order to conduct a series of studies on what CEE represents, how it is implemented throughout the world,what are the needs and what is available in industrializing countries.

vel of economical development and the activity level of CEE for a specific country /2/. CEE, therefore, represents an outstanding problem in industrializing countries. In fact, the development of any industrializing country is highly dependent upon the technical knowledge and skills of its engineers. Such knowledge and skills can be increased through CEE by transfer of know-how from advanced industries, research institutions etc.

On the other hand, in highly industrialized countries CEE is so diffused that there is even a need for quality assurance. In these countries CEE is offered by industries, research laboratories, consulting firms, professional organizations and other development centers.

In some countries the needs of the engineers planning to attend these CEE courses are analyzed and then oriented courses

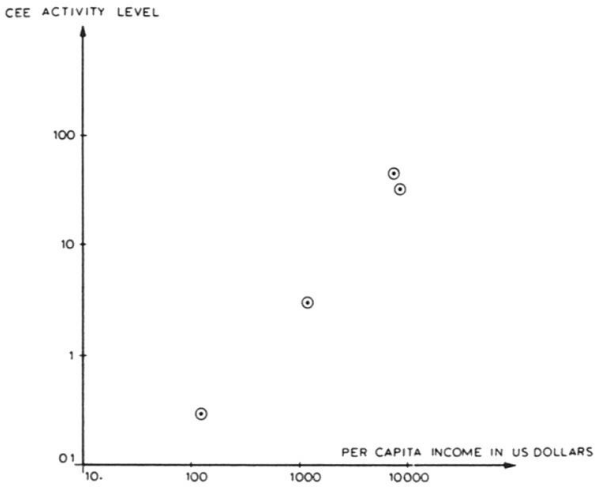

Fig. 4 - Relationship between per capita income and CEE activity level
Source: N.K. OVESEN /2/

SEFI (Societé pour la Formation des Ingenieurs) has been established in Europe in 1972. This society has been extremely active in the field of Educational Development of Engineers and it has been particularly concernend whit initial education and the links beween these two aspects of education which cannot be con-

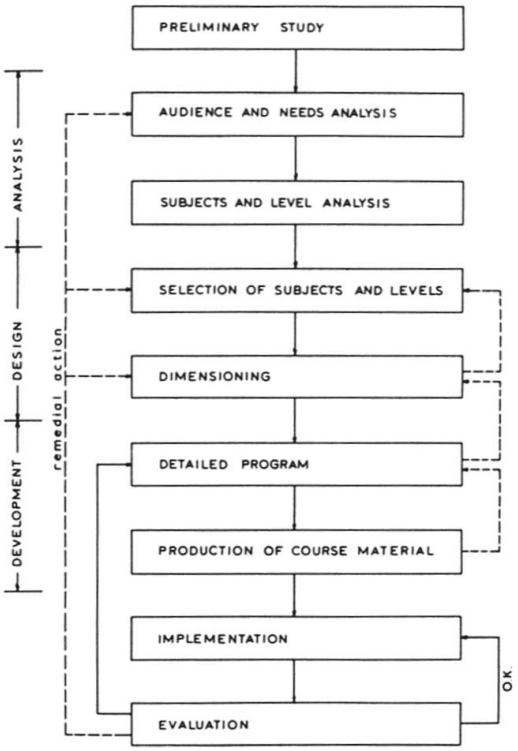

Fig. 5 - Design of refresher courses.
Source: G. CICCARELLA et al. /3/

sidered separate, the aims of the society being: to promote information on engineering education and to improve communications and exchanges between teachers, researchers and students in Europe.

SEFI's intense activity (Fig. 7) has been broadened through its activities (annual conferences and world conferences, working groups) and its pubblications (European Journal of Engineering Education, SEFI News, SEFI guide 1 & 2).

Other organizations worth mentioning, since they play an important role in CEE, are the professional engineering organizations.
Some of the most important are shown in (Fig. 8).

However, even though there are so many organizations for CEE in developing countries, the problem of CEE is still strongly felt. In these countries,in fact,the lack of development cannot be ascribed to the initial education, usually acquired by engineers abroad, but to the lack of CEE which stops the professional growth of the engineer. In these countries professional bodies are either non-existent or are in their early stages of development and hence cannot effectively contribute to the important job of CEE /5/.

3. CONTINUING EDUCATION OF STRUCTURAL ENGINEERS

In the process of scientific evolution and technological innovation an important place is occupied by structural engineering which can boast of old scientific traditions in the field of strength of materials and theory of structures, and was based on a rich body of knowledge in theoretical and technical contributions. But it is only in the last twenty years that the technological evolution of materials, the success of new structural types and the progress of construction techniques on the one hand, and the improvement of the theoretical calculation and experimental control methods together with the introduction of modern criteria of structural reliability, on the other hand, have encoura

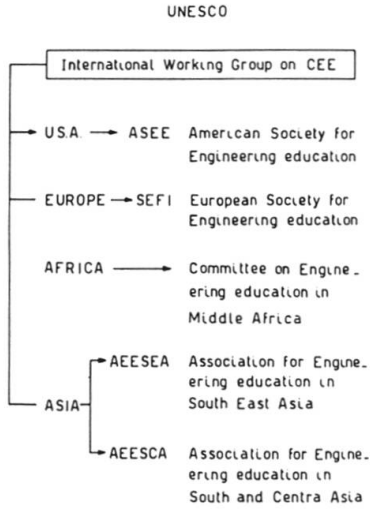

Fig. 6 - International organizations on CEE

1) ANNUAL CONFERENCES

2) WORLD CONFERENCES

1979 First W.C. on CE
Mexico City

1983 Second W.C. on CE
Paris

3) WORKING GROUPS

4) PUBLICATIONS

4a) European Journal of Eng. Ed.

4b) SEFI-News

4c) SEFI-Guide I (1978)
II (1983)

Fig. 7 - SEFI activities in CEE

ged progress in the quality of structu ral engineering.

It is possible today to formulate and solve problems in a way that was not possible twenty or thirty years ago.

It is now necessary to specify that structural engineering is usually referred to the conception, design and execution of civil engineering works, even if the basic criteria of structural analysis are common to other types of constructions (naval or aeronautical constructions). As a matter of fact, the latter have often developed analysis methods that have been used in the calculation of civil engineering stru ctures.

Hereafter we will be concerned with the aims, the contents and the organization of Continuing Education for Structural Engineers.

There will be, however, connections with other disciplinary areas, e.g. mathematics for structural analysis, advanced methods, seismology for earthquake analy sis, geotechnique for foundation engineering.

3.1 Basic training in the field of structural engineering

Progress in the field of structural engineering is so rapid that it is becoming more and more difficult to define a comprehensive curriculum leading to a satisfactory knowledge on materials and structures.

However, a specific combination of courses and training seems to offer the best possibilities. The behaviour of materials and structures can only be understood by having a fundamental knowledge that does not become obsolete and is capable of adaptation or innovation.

Therefore, the university courses which can contribute to a structural engineering training must necessarily cover the areas of mathematical fundamentals, mechanics fundamentals, structural material properties, structural element beha viour, structural types, calculation methods, experimental analysis and control of materials and structures, and computer programming.

— W.F.E.O. World Federation of Engineering Organizations

— U.A.T.I. Union of International Engineering Organizations

— U.P.A.D.I. Pan American Federation of Engineering Societies

— F.E.A.N.I. European Federation of National Engineering Institutions

Fig. 8 - Main professional engineering organizations

The knowledge of these subjects, acquired by means of courses distributed over the different periods of the engineering education can be integrated by technical visits to testing laboratories, to computer centers, or construction work, or by stages which in some technical universities cover an academic semester; conversely, this seems to be more useful for industrial engineering than for civil engineerig.

It is, however, profitable to develop, even in undergraduate courses, intuitive skills and professional interest in structural engineering.

3.2 Organization of CESE

3.2.1 Aims

In the civil engineering field, where a civil construction industry, comparable to the mechanical or electrical industries, does not exist, Continuing Education must represent a substitute for research and development which in the other branches of engineering plays a useful role within industry itself.

In the civil engineering field, and especially in structural engineering, Continuing Education is fundamental for developing countries where enormous programmes for infrastructures and construction are in progress, and an updated know-how is required in structural design and construction techniques for industrialized countries.

3.2.2 Contents

Continuing Education in Structural Engineering must, therefore, offer new and advanced knowledge, which supplements that already acquired or replaces what is obsolete. This is the reason why the subjects of greater interest, which are present in many programmes of Continuing Education in various countries, seem to be in the following field: applied mathematics, structural analysis, structural materials, structural systems behaviour, structural types, construction techniques, structural reliability, etc..

All these subjects are merely indicative of the vastness of topics which can be treated in Structural Engineering Continuing Education courses or seminars.Other more modern subjects concern the fields of material science and structural engineering, up to the boundaries of other disciplines such as fracture mechanics, elastic and structural engineering, soil and structural engineering, soil and structural seismic dynamics, structural strengthening, offshore structures, nuclear power plants structures, etc..

Furthermore, in civil engineering education non-technical courses, essentially in the field of economics and management, are also required: in the U.S.A. these courses include up to 50% of engineers involved in technical courses. In France the Ecole National des Ponts et Chaussees offers in the continuing education program of 1980 some courses on "programmation et gestion".

A very attractive proposal is to include also courses of aesthetics which concerns an important part of structural design. The professional structural engineers of the future should be capable of integrating aesthetic objectives with engineering solutions. Many years ago Nervi used for the latter the term "structural architecture".

3.2.3 Methods

Continuing Education methods can be very different according to location, duration and how they are given. Among direct methods or live instruction methods,we can mention: post graduate courses, evening courses, short courses, etc..

Among indirect methods, correspondance courses have been used for many years; they involve a continuous exchange between teachers and students, conducted primarily by written comunication. They present a great flexibility of choice for the student who can decide when, where and how he will study.

A recent method is the so called "self study course" that corresponds to an instruction program in which the student is provided with all materials and left to proceed with no direct aid from an instructor.

Another possibility for following the more recent progress in various specialized fields of structural engineering is offerend by conferences or symposia.They are very succesful when they create a balance between theoretical advancements on the one hand and technical progress on the other. Each year a certain number of colloquia are organized by national professional societies or by international technical associations such IABSE, CEB, ECCS, RILEM, etc. for a short period (two, three days).

3.2.4 Teaching institutions

The organization of Continuing Education is affected by many factors which differ from country to country and from time to time according to the cultural, technical, economical and political situation.

A very important role is played by the engineering schools which must very clearly define the objectives of a continuing education program compared with the objectives of the undergraduate and graduate curricula. Continuing Education cannot consist in an extension of the regular programs, but must clearly be finalized with target programs, also prepared in cooperation with engineering societies or industries. The teaching staff must include persons from industry in order to enrich the courses with professional experience. Also the professional societies have a great role in the Structural Engineering Continuing Education. They use teaching staff from any source (university, industry, consultants) and can present Continuing Education programs in any place where a sufficient audience is expected. The organization of Continuing Education in Structural Engineering is summarized in Fig. 9.

3.2.5 Other aspects

Another problem concerning Continuing Education is the legal aspect, a point that should not be overlooked.

While in many countries Continuing Education is still organized on a more or less individual basis, there are some countries, as will be shown in the next section, where an appropriate legislation exists.

A very important aspect of Continuing Education is the problem of teaching staff, for wich the keeping up-to-date requirements must be constantly taken into ac-

count. This could be encouraged by study programs, participation in activities of short and long term Continuing Education (see Recommendations of the International Conference of Education and Training of Engineers and higher Technicians, New Dehli, India, 1976).

4. IABSE SURVEY IN CESE

Actually, up to date Continuing Education of Structural Engineers in the world can be considered to be the result of spontaneous flourishing of many initiatives coming from different sources. It is up to the international organizations in the field of structural engineering to undertake the task of coordinating and informing engineers of CESE. This task has to be accomplished through the cooperation with the existing international organizations mentioned before, the initiative being taken by the structural organization. (Fig. 10).

The International Association for Bridge and Structural Engineering, IABSE, having recognized this need, decided to carry out a more specific survey on CESE in 1982, in order to formulate concrete proposals for IABSE policy in this field.

A first preliminary report was presented in Washington in 1982, based upon the international reports available at that time, even if the attention was focussed on the structural field.

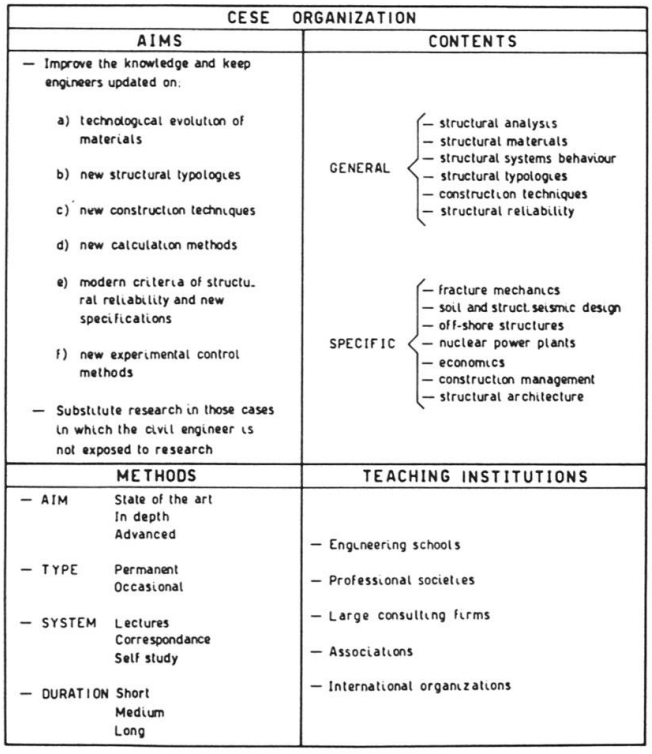

Fig. 9 - Organization of Continuing Education of Structural Engineers

The need of carrying out a more specific survey among all the countries associated to IABSE on CESE was recognized. Even though no pretence was made to cover all the available courses offered around the world, the aim was to investigate how the problem of CESE was seen by IABSE members.

As shown by the first preliminary report presented in Washington in 1982, the information available on CESE was extremely dispersed and scattered. It was therefore necessary to organize the available and future information in a table form which allowed drawing some conclusions from the analysis of the data.

- C.E.B. Comité Europee du Béton
- C.I.B. International Council for building research Studies and Documentation
- E.C.C.S. European Convention for Constructional Steelwork
- F.I.P. Fédération International de la Precontrainte
- I.A.B.S.E. International Organization for Bridges and Structural Engineering
- I.A.E.E. International Association for Earthquake Engineering
- I.A.S.S. International Association for Shell and Spatial Structures
- I.U.T.A.M. International Union for Theoretical and Applied Mechanics
- R.I.L.E.M. Reunion International des Laboratoires d'Essais et des recherhes sur les materiaux et sur les constructions

Fig. 10 - Main international organizations in structural engineering

Hence it was decided to carry out the survey on the basis of the questionnaire provided in the first column of Fig.11.

An ad hoc questionnaire, consisting of 18 questions was developed. Some of the questions are more general concerning the policy of the country on Continuing Education, particularly in the field of civil and structural engineering, as well as the initiatives existing in the country in this field. The other questions are more specific since they concern the type, aim, system, duration, main purpose and topics of courses, average of students, where students mainly come from, refresher courses for teachers, final assessment of grading and any special program for developing countries.

QUESTION \ COUNTRY		ARGENTINA	AUSTRALIA	AUSTRIA	BELGIUM	BRASIL	CANADA	CHINA	CZECHOSLOV	DENMARK	EGYPT	FINLAND	FRANCE	GERM. DEM. REP.	GERM. FED. REP. OF	GREECE	HUNGARY	INDIA	ISRAEL	ITALY	JAPAN	LUXEMBOURG	NETHERLANDS	NIGERIA	NORWAY	POLAND	PORTUGAL	ROMANIA	SOUTH AFRICA	SPAIN	SWEDEN	SWITZERLAND	TURKEY	UNITED KINGD.	USA	URSS	YUGOSLAVIA
NO		RA	AUS	A	B	BR	CDN	RC	CS	DK	ET	SF	F	DDR	D	GR	H	IND	IL	I	J	L	NL	WAN	N	PL	P	RO	ZA	E	S	SW	T	GB	USA	URSS	Y
1	IS THERE ANY LAW ON CONT ED ?		NO	NO	NO		NO	NO	YES	NO		NO	YES		NO		YES			NO	YES		YES		NO		NO		NO		NO	NO		NO	NO		NO
1.2	ARE THERE INITIATIVES ?		YES	YES	YES		YES	YES	YES	YES		YES			YES		YES			YES	YES		YES		YES		YES		YES		YES			YES	YES		YES
2	ARE THERE INITIATIVES IN CIVIL STRUCTURAL ENG ?		YES	YES	YES		YES	YES	YES	YES		YES	YES		YES		YES			YES	YES		YES		YES		YES		YES		YES	NO		YES	NO		YES
3	WHICH KIND OF INITIATIVES? COURSES(C) SEMINARS(S) TECHNICAL VISITS(TV)		C		C		C S	C	C	C		C S TV	C		C		C TV			C S			C		-		C S TV		C		C S TV	C S TV		C S TV	C S TV		C
3.1	WHAT KIND OF COURSES? POSTGRADUATE (PG) VARIOUS (VA)		PG		PG		VA	PG	PG	VA		J D DAY	VA				PG VA			PG VA					1 DAYS		VA				PG			PG	VA		PG
3.11	AIM STATE OF THE ART(SA) IN DEPTH (ID) ADVANCED (AD)		SA ID AD		SA		SA	ID AD	AD	ID		SA	SA ID AD		SA		ID AD			SA ID	SA ID AC		ID AD		ID AD		D AD		SA D AD		SA D	ID AD		SA D AD	D AD		D
3.12	TYPE PERMANENT (P) OCCASIONAL (O)		O	O	O		O		O	O		O	P		O		P			O P	P		O P		O		P		P		O	P O		P	P O		P
3.13	SYSTEM LECTURES (L) CORRESPONDANCE (C) SELF STUDY (S)		L		L		L	L	L	L		L	L		S		L			L	L		L		L		L		L		L	L		L	L S		L
3.14	DURATION SHORT (S) MEDIENNE (M) LONG COURSES (L)		L	S	S M L		S	S L	L	S M		M	S M L		M		S M L			S M L	S L		S M		S L		S M L		S L		S M L	S M		S M	L
3.2	OTHER INITIATIVES		YES		YES		YES	YES	YES	NO		YES	YES		YES					YES	YES		YES		NO		YES		YES			YES	YES			YES
4.1	PARTICIPANTS FROM ? UNIVERSITIES (U) SOCIETIES (S) INDUSTRIES (I)		U S I		U I		S I	U I	.	U S I		.	U S I		U S I		U S			U S I	U S I		U S I		U S I				S I		S I	Y S I			S I		Y S
4.2	MAIN PURPOSE RESEARCH (R) DESIGN (D) CONST PRACTICE (C)		R D C		D C		D C	R D	R D	0		D C	R D		D C		R D			R D	R D CP		D C		D		R D		D C		D C	D CP		D C	D CP		0
4.3	MAIN TOPICS EARTHQ (E) FINITE ELEMENTS (FE) THEORY OF STRUCT (TS) CA STEEL (S)		C TS	E CA	FE			FE	TS CA S								TS			E CA	E		FE D		TS		E CA		CA I C		FE TS CA S			CA I C	E FE TS CA S		TS CA
4.4	PROGRAMS FOR DEVELOPING CONTRIES		NO		NO		NO		NO	YES		YES	YES		NO		NO			NO	NO		NO		NO				NO		NO	NO		YES	YES		NO
4.5	AVERAGE OF STUDENTS		30					30	30	34		35	35		30-40		30-35				30				40				27		35	30		4.75	35		20-30
4.6	STUDENTS ENROLLED AND PERCENTAGE OF C E STUDENTS																				142		250														25
4.7	FINAL GRADINGS		YES		NO				NO	NO		NO	YES		NO		YES			NO	YES		YES		NO				NO		NO	YES		NO	YES		NO
4.8	UPDATING OF TEACHERS		NO		NO	NO			NO	NO		NO	YES		NO	NO				NO	NO		NO		NO				NO		NO	YES		NO	YES		NO

Fig. 11 - Results of the survey

The questionnaire has been sent to all Chairmen and secretairies of IABSE national groups (36) and to all the other member countries (54) of IABSE, for a total of 144 enquiries.

Out of the 36 national groups, 13 completed the questionnaire, while of the other 54 member countries of IABSE, only one answer was received. The total number of answers was 22.

A first evaluation of the available data indicated a fairly homogeneous situation in the countries which answered the questionnaire. It was then decided to limit the analysis to the 36 countries represented by national groups in IABSE.

A second questionnaire, which partially modified the previous one, was made on the basis of the answers given. As stated previously, it was directed only to the 36 national groups.

Particular attention was given to those countries which were not included in the first analysis of data, but in which Continuing Education in Structural Engineering played a major role. In these cases questionnaires were sent also to members who were known by means of personal contacts.

This second enquiry was more successful than the first one: out of 151, 37 answered from 13 countries. The picture concerning the 36 national groups of IABSE was therefore almost complete since only 10 countries were not present.

The complete result of the survey is given in Fig. 11 where the answers to all the questions of the questionnaire are provided for each country.

As shown in this figure, the answers to the questionnaire are quite homogeneous. The following conclusions can be therefore drawn from this first survey: even though there are not generally laws on continuing education, there are initiatives, particularly in the field of civil and structural engineering, in all the countries, the initiatives coming from universities, engineering associations and industry. These initiatives are mainly offered in the form of refresher courses at postgraduate level aimed at providing engineers with up-to-date knowledge in their field and usually consist of lectures. The courses are of different duration (short, medium, long), even if short courses prevail and usually are occasional. Some institutions do instead offer permanent courses. The aim of the courses varies since they range from state of the art courses to in-depth and ad

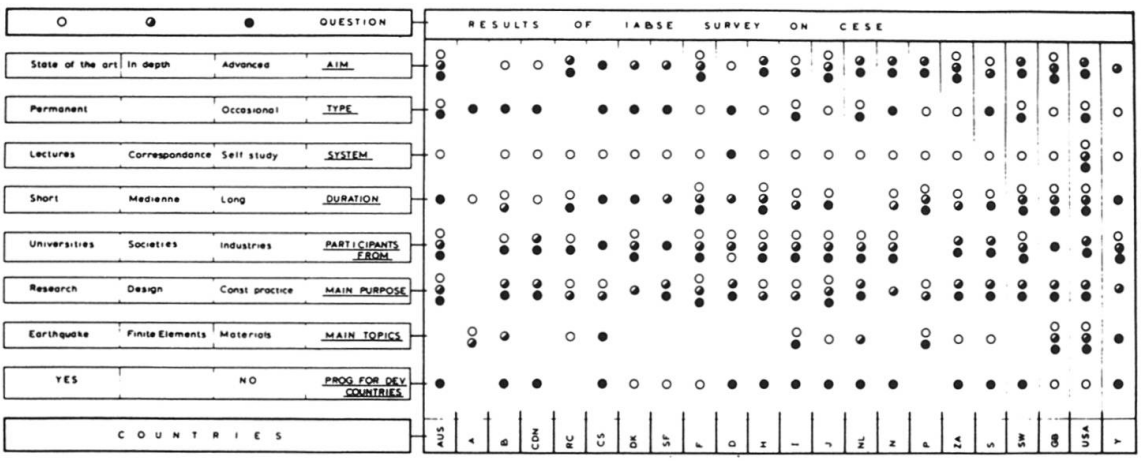

Fig. 12 - Answers to the most significant questions

vanced courses. The partecipants come mainly from industry and associations although there are people from universities. The main purpose of the courses concerns design and construction practice, the topics being somewhat widely spread out. While in the countries in which CESE is more developed there are courses offered in almost all the fields of structural engineering, in the other countries some topics are recurrent: finite elements, computer aided design, new design methods for concrete and steel technology. The average number of the partecipants is about 35, the percentage of civil engineers being difficult to evaluation from the available data. Usually there is no final assessment of grading and no updating of teachers. Neither there are special programs for developing countries.

In Fig. 12 asummary of the answers to the most significant questions are given for each country which responded.

In Fig. 13 instead, the percentages of each type of answer to the same questions are provided.

The results of this first survey were extremely satisfactory since the answers received by almost all the 36 national groups of IABSE were quite homogeneous. The survey should now be carried out more deeply in each country in order to investigate what are the courses offered around the world. It is, however, possible to formulate now some concrete proposals for IABSE policy in the field of Continuing Education of Structural Engineers.

5. CONCLUSIONS AND PROPOSALS

Even though the activity of Internationa Organizations is very intense in the field of Continuing Education of Engineers, up till now, there is no systematic information on the specific field of Structural Engineering.

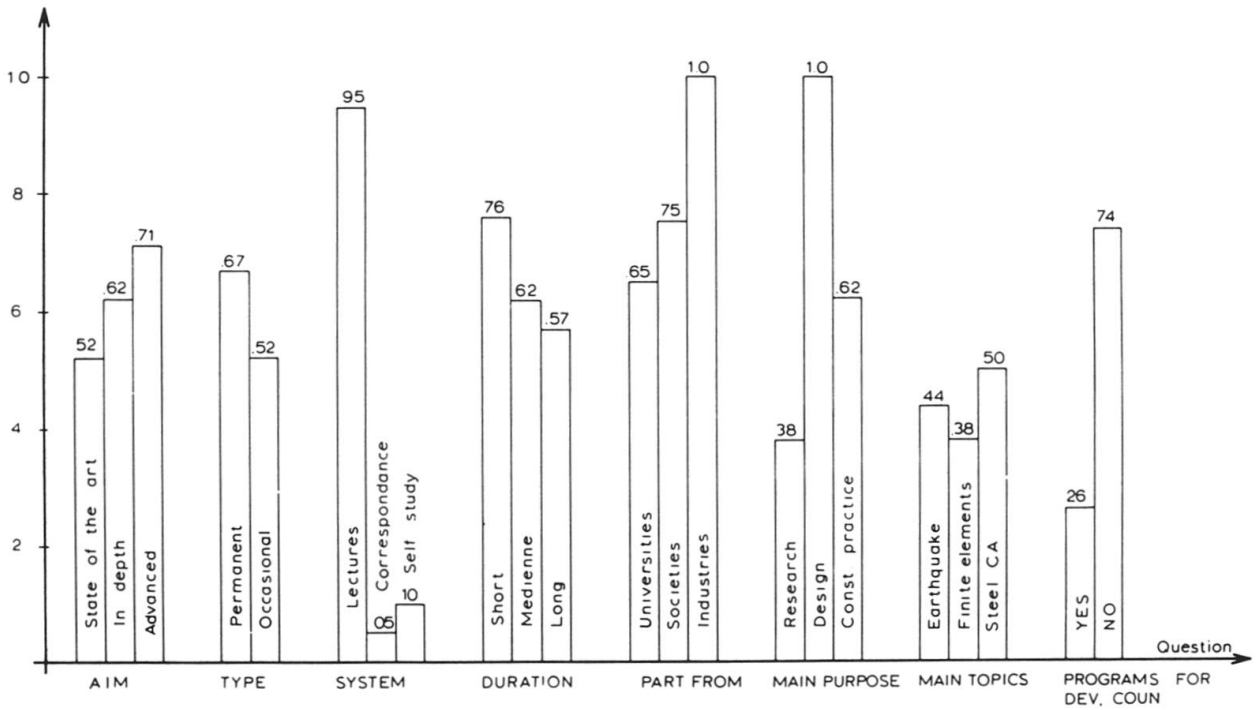

Fig. 13 - Percentages of each type of answer to the main questions

However, even if scattered and mostly not on a permanent basis, updating courses in structural engineering are offered the world over.

IABSE, through its widespread organization, succeeded in gathering the data reported herein, by means of a questionnaire form, in an attempt to derive a complete picture of what is available in all the member countries of IABSE, thus allowing homogeneous comparisons to be made.

A total of almost three hundred questionnaires have been sent out worldwide for this purpose. The results of this effort even though not yet completed, have been presented in this report. They can be definitely considered satisfactory. The complete picture (Fig. 11), has been discussed in the previous section, together with the comparisons (figs 12, 13).

A major point, which comes out of this survey, is represented by the urgent need of CESE in developing countries.

On the one hand, these countries call for an updating of their engineers, which knowledge is satisfactory at initial education level, but becomes obsolete after a few years due to the absence of CESE; on the other hand, there are no major programs in most developing countries with IABSE members.

Even though the survey should now be carried out more deeply in each country in order to investigate on the courses actually offered, it seems that the following concrete proposals for IABSE policy in the field of CESE can now be formulated:

- identify members who are interested in this field and want to cooperate in a working group:
  - for studying the possibility of organizing an ad hoc workshop, also with participation of people involved in specific associations for engineering educations, i.e. UNESCO/SEFI/ASEE etc., and of the main structural association as CEB, CECM, FIP, RILEM;
  - for organizing international courses on structural engineering.

Anyhow, some suggestions are provided hereafter for tasks which could be taken by IABSE in CESE:

a) coordinate information on all the available courses in structural engineering;
b) promote short courses in the different countries with particular attention to developing countries' needs;
c) promote long courses ("itinerating ones"), to be held each year in a different country.

Particularly, the short courses, from one day to one week, should be state of the art ones and should deal with new technologies, new computational methods and design techniques, discussion of new specifications, etc..

In this way, by taking into account the needs of developing countries in the design of courses, the latter could provide updating of engineers of these countries thus filling the existing gap between initial and continuing education.

A proposal is also formulated for the "itinerating" long courses. They should last about ten weeks and should be particularly concernend with local technologies, problems, etc.. In this way a complete knowledge of existing construction

technologies could be gathered after few years.

Field experience, as well as theoretical aspects should be provided in order to fulfil the demands of engineers coming from different working places. An example of such a course is given hereafter.

In Italy, where the recent strong earthquakes caused exentive damage, there has been a great amount of public money involved in the reconstruction of large areas and in the strengthening of historical sites, monuments, etc.. The activity of building contractors has, therefore, been extremely intense in this period, with application of different techniques in the reconstruction of about 2000 residential buildings.

An extremely stimulating course could then be offered on seismic design, building technology and strengthening techniques. Teachers should come from local and non-local universities as well as from building industries. Morning lectures could be offered while field experience could be acquired in the afternoon.

This type of course organized as shown in Fig. 14 could improve engineering knowledge on theoretical aspects: seismic design, strengthening techniques, etc., representing one of the most significant developments in engineering education in Europe in recent years.

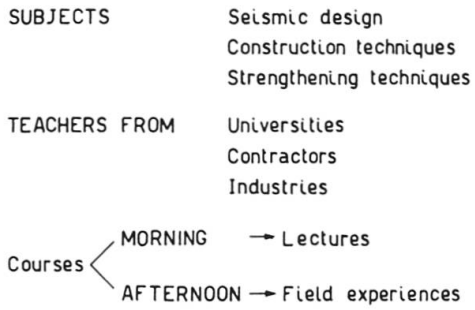

Fig. 14 - Example of itinerating long course

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