INQUIRIES INTO EUROPEAN HIGHER EDUCATION IN CIVIL ENGINEERING

EUCEET

SOCRATES - ERASMUS
THEMATIC NETWORK PROJECT

EUROPEAN CIVIL ENGINEERING EDUCATION AND TRAINING

FIRST EUCEET VOLUME

Edited by
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Foreword

This is the first of a serie of volumes to be published within the frame of the *Thematic Network project EUCEET (European Civil Engineering Education and Training)*, run on the basis of a grant of the European Commission under the auspices of the Erasmus component of the SOCRATES programme.

The volume is divided into four parts.

Part I, dealing with general issues, contains two papers. The first one is giving a presentation of the project activities in the first two years (1 September 1998 – 31 August 2000), including informations on the attendance of various meetings and on the project partners. The second one is trying to situate civil engineering education and EUCEET in the context of the processes underway in the European higher education area.

Parts II, III and IV of the volume were prepared by the EUCEET Working Groups A, B and C, respectively. Synthesis of the activities are given, as well as main outcomes: papers, reports, surveys etc.

The editors express their gratitude to those who, through their support and enthusiasm, made this volume possible.

The editors

About the Editors

Iacint MANOLIU is Professor of Geotechnical Engineering at the Technical University of Civil Engineering in Bucharest, where he graduated in 1957 and got his Ph D in 1974. He spent one year (1968) as a Fulbright scholar at the University of Texas at Austin. Served as Vice-Dean of the Faculty of Civil, Industrial & Agricultural Buildings between 1972 - 1976 and as Dean of the same Faculty between 1976 – 1984. Between 1990 and 2000 was Vice-Rector for Academic and International Affairs of the TUCEB. Presently is President of the Council for Cooperation and Relations of the University. Between 1991 and 2001 initiated and coordinated 5 Tempus projects. Is Secretary General of the Steering Committee of the SOCRATES-Erasmus Thematic Network Project EUCEET. Prof. Manoliu is President of the Romanian Geotechnical Society, Vice-President of the Union of Associations of Civil Engineers of Romania, member of the Board of AECEF (Association of European Civil Engineering Faculties, Vice-President of ECCE (European Council of Civil Engineers) and member of the Administrative Council of SEFI (Société Européenne pour la Formation des Ingenieurs).

Tudor BUGNARIU is Associate Professor at the Technical University of Civil Engineering in Bucharest, where he graduated in 1984 and got his Ph D in 1997. Between 1984 and 1991 he worked as design engineer for the Metropolitan Construction Company in Bucharest. He is teaching structures design, C.A.D. and the Finite Element Method. Begining with 1990 he is member of the Romanian Association of Structural Engineers. Since 1999 is contact person and deputy chairman for the Working Group A of the SOCRATES - Erasmus Thematic Network Project EUCEET

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Iacint MANOLIU
T.U.C.E. Bucharest (RO)

EUCEET - THE FIRST TWO YEARS: 1998/1999, 1999/2000

Prof. Marie-Ange CAMMAROTA
Ecole Nationale des Ponts et Chaussées, Paris

Prof. Iacint MANOLIU
Technical University of Civil Engineering, Bucharest

1. Introduction

The ERASMUS chapter on higher education of the SOCRATES programme, launched by the European Commission in 1995 included a new and distinct action: *Thematic Network projects* (or **"university co-operation projects on subjects of common interest"**). Thematic Network projects were aimed to the creation of forums to analyse and study the status of development in the different fields of education in Europe, with the objective of promoting the European dimension and of improving the quality of training. Also, they were meant to involve faculties and departments of institutions of higher education, as well as scientific and professional associations, in order to ensure a wide impact, both at institutional and at intra - and inter - disciplinary levels.

24 first - generation Networks, approved in September 1996, started to function in 1996/97. Eight second - generation Networks were approved in 1997 and nine in 1998, among which the Thematic Network Project EUCEET (**EU**ropean **C**ivil **E**ngineering **E**ducation and **T**raining).

2. Origin of EUCEET

A Tempus Complementary Measures Project called CESCOOP (**C**ivil **E**ngineering **S**chools **COOP**eration) was proposed by the Technical University of Civil Engineering Bucharest and approved in 1996. The idea behind the proposal was to put together two groups of universities, one previously involved in a Tempus Mobility Joint European Project called CESNET (**C**ivil **E**ngineering **S**chools **NET**work) and the second previously involved in an ERASMUS ICP. CESCOOP partners were 15 universities, among which 11 from EU (ENPC Paris, INSA Lyon, Imperial College London, City University London, Leeds University, T.U. Berlin, T.U. Dresden, Politecnico di Torino, Universitat Politecnica de Catalunya Barcelona, Instituto Superior Tecnico Lisbon, National Technical University Athens) and 4 from Romania (Technical University of Civil Engineering of Bucharest, Technical University Iasi, University Politehnica Timisoara, Technical University Cluj-Napoca).

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At a joint CESCOOP - CESNET workshop which took place in February 1997 in Athens, various aspects concerning the joint involvement of partners in the new SOCRATES programme were discussed.

A proposal for the creation of the Thematic Network EUCEET was formulated by Prof. Iacint Manoliu, coordinator of CESCOOP and CESNET Tempus projects, and circulated among CESCOOP and CESNET partners in April 1997, receiving a strong support.

On the occasion of the 2nd General Assembly of the Association of European Civil Engineering Faculties AECEF (Odense, 5 May 1997) Prof. Iacint Manoliu made a presentation on the EUCEET. Both AECEF leaders and representatives of Faculties attending the Assembly expressed their great interest in the project.

At the 25th meeting of the European Council of Civil Engineers - ECCE, held on 6-7 June 1997 in Paris, Prof. Iacint Manoliu informed the participants about the EUCEET initiative and invited representatives of various national professional associations attending the meeting to join the network.

At a meeting of CESCOOP partners, which took place in Barcelona on July 14, 1997, a final decision for the foundation of the Thematic Network was adopted. The Ecole Nationale des Ponts et Chaussées Paris, represented by Prof. Marie-Ange Cammarota, assumed the role of coordinator/ contractor.

A Steering Committee was formed, chaired by Prof. Marie-Ange Cammarota (ENPC) and made of the representatives of the following universities: ENPC Paris, Imperial College London, City University London, T.U. Berlin, Politecnico di Torino, Universidad Politecnica de Madrid, Universitat Politecnica de Catalunya Barcelona, Instituto Superior Tecnico Lisbon, National Technical University Athens, Technical University of Civil Engineering of Bucharest. Prof. Iacint Manoliu was designated as Secretary General of the Steering Committee.

In the period following the Barcelona meeting, members of the Steering Committee were active in bringing new members in the network. This task was also successfully accomplished by members of the AECEF Board.

In another joint CESCOOP - CESNET meeting hosted by Cluj-Napoca on 29-30 September 1997, a state-of-the art of the Network was presented. The main objectives and activities of the Network were also examined. Participants to the meeting were extremely pleased by the fact that a significant number of leading European universities in the field of civil engineering, renowned for the high quality of education and research, representing almost all eligible countries, accepted the invitation to join the Network. This created a very sound base for the accomplishment of the project goals.

The Secretary General was assigned the task to prepare on behalf of the Steering Committee, the *"Expression of interest"* due to be sent by 1st January 1998 to the European Commission. EUCEET successfully passed this first phase of the selection procedure.

Therefore, the full application for support was prepared and submitted to the EC by 1st April 1998. The good news of the approval was received by the Coordinator on October 19, 1998. The code number of EUCEET is: 55779 - CP - 1 - 98 - FR - ERASMUS - ETN.

3. Reasons for creating the thematic network EUCEET

• It is well known that engineering higher education in all European countries started with courses in civil engineering. For centuries, civil engineering schools have played a major role in the advancement of the European science and technology. Their contribution toward providing a civilised life in Europe was and continue to be tremendous.
• At present, civil engineering represents the branch (department) most frequently found in the structure of the technical higher education institutions in Europe. At the same time, due to traditions, to local circumstances, to demands of the economic environment a. s. o., there are significant differences in the civil engineering education programmes between various European countries. There is a strong and urgent need for a comprehensive review of existing academic curricula, for collecting and disseminating, relevant information, for identifying the elements of a European dimension for the civil engineering field. This is a good reason for creating the Thematic Network EUCEET.
• There is a wide spectrum of postgraduate forms of education in civil engineering, offered by the different academic institutions in Europe. The detailed evaluation and comparison of their results is also needed and should represent a sound base for joint curriculum development activities, such as universities programmes of "Master" type and European modules, within the Institutional Contract of the Erasmus component of SOCRATES.
Postgraduate education relates intimately to continuing professional development, a process in which the involvement of universities is of major importance. Assessing the demand for and supply of continuing education for the construction industry in Europe and the role of higher education institutions to meet these needs represents a challenge of great actuality. A network such as EUCEET could be very instrumental in facing this challenge.
• As shown in a recent Communication from the European Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of Regions on **"The Competitiveness of the Construction Industry"**, *"The construction industry (which includes housing, non-residential buildings, civil engineering and industrial construction) is a major constituent of the European Union's economy. The gross output of the construction sector in the fifteen member states amounted to 750 billion ECU in 1996, which represents approximately 11% of Community GDP and 5.6% of the value added. This makes it the largest industrial sector."*

Among the actions to achieve a European strategy for the competitivity of the construction sector, the document mentions as a main objective *to improve education and training provision* and includes the recommendation of the Commission to promote European *networking of construction training and educational organisations*.

The EUCEET project represents a concrete step toward the achievement of this goal. Through the network, relevant issues in civil engineering education and training will be put on the policy agenda of education institutions and of professional associations as well.

• Like for other engineering schools, the quality assurance is a central issue on the agenda of civil engineering faculties and departments across Europe. An international symposium on this matter, held in May 1997 in Odense, under the auspices of the European Association of Civil Engineering Faculties, showed that the process of assuring and improving the quality of civil engineering education varies considerably from country to country. The mutual recognition of degrees and qualifications cannot be separated from the establishment by the civil engineering schools of a set of comparison criteria to assess their educational achievements. This could be accomplished by the network EUCEET.

• There are more than 20 years since the Commission of the European Communities took the initiative for elaborating an international set of Codes for structural design – EUROCODES. Today most of these Codes are already published as European Prestandards (ENV) and after a test period of several years are going to become European Norms (EN) replacing national standards. This represents a true revolution in the design practice which puts a serious challenge to civil engineering schools in Europe. Matters related to the contribution of these institutions to the implementation of EUROCODES into practice will be thoroughly considered by the Thematic Network EUCEET.

• In the recommendations for improved competitiveness, the Communication from the EC mentioned above, included the following ones:

- *steering research at all levels of the sector towards constructive processes: management aspects, construction methods and "sustainable" materials and structures*
- *improving the dissemination of research findings.*

Civil engineering schools have to contribute to the competitiveness of the construction sector in Europe by their active participation to the construction research. This should be done in synergy with the research institutes and the industry. The Network EUCEET is aimed to enhance such a synergy and to promote a debate on the involvement of all partners in the implementation of the 5th Framework Programme.

• Civil engineering is, undoubtedly, the engineering field in Europe which bears the greatest responsibility for ensuring the quality, safety and the overall sustainability of the built environment and for protecting the natural environment. The dialogue between academic institutions, public authorities and professional associations is of paramount importance in this field, more than in any other engineering field. The Thematic Network EUCEET will be a forum for such a fruitful dialogue.

These were just a few, but very strong reasons for creating the Thematic Network EUCEET, included in the application sent to Brussels. The very fact that the application was approved shows that they have been given due consideration.

4. Network partners

In the full application approved by the EC, 58 partners were listed, and represented the partners in the first year of the project (1998/1999). In the renewal application for the second year of the project (1999-2000) sent to Brussels on 1st March 1999, 9 new partners were added. Finally, based on new letters of endorsement addressed to the coordinator by 1st March 2000, other 14 new partners joined the Network, which reached in the last year of the project a total number of 80 partners.

In the table 1 is given the distribution of the total number of partners, between various types of organisations.

In the Figure 1 is shown the evolution of countries represented in the network, from the 1st to 3rd year of the project.

Table 1

Code	Type of organisation	Number of partners		
		1998/1999	1999/2000	2000/2001
EDU.4	Higher education institution	43	50	59
ASS.1	Non-profit association (national)	7	8	13
ASS.2	Non-profit association (international)	2	2	2
ASS.3	Association of Universities	1	1	1
RES	Research institute	5	5	5
TOTAL		58	66	80

The distribution of the number of academic partners (EDU.4) per countries and per year is shown in the table 2.

It is important to underline the constant increase of the number of partners from associated countries, from 10 in 1998/1999 to 16 in 1999/2000 and to 22 in 2000/2001. By this way, the academic partners from the associated countries will represent in 2000/2001 37% from the total number of academic partners.

In the annex III is given the complete list of partners in the Thematic Network Project EUCEET, as included in the Renewal Forms sent to Brussels by 1st March 2000.

Figure 1 Countries represented in the network and locations of EUCEET meetings

Table 2

EU + EEA (15 + 3) countries																	
year	AT	BE	DE	DK	ES	FI	FR	GR	IE	IT	LI	NO	NL	PT	SE	UK	Tl.
1998/1999	1	3	4	1	3	1	3	2	1	2	1	1	1	4	1	4	33
1999/2000	1	3	4	2	3	1	3	2	1	2	1	1	1	4	1	4	34
2000/2001	1	3	4	2	3	1	4	2	1	3	-	1	1	4	2	5	37

Associated countries											
year	BG	CZ	EE	HU	LT	LV	PL	RO	SI	SK	Total
1998/1999	-	2	-	1	-	1*	-	4	-	2*	10
1999/2000	-	2	1	1	1	1	2	4	2	2	16
2000/2001	1	3	1	1	1	1	4	5	2	3	22

Legend: * non-eligible for financial support

5. General aim and objectives of the project

The main objective of the project is *to enhance the cooperation between universities, faculties and departments of civil engineering in Europe, with the involvement of academic and professional associations, in order to contribute to the development of civil engineering education and to increase its quality and effectiveness.*

In order to accomplish the main objective, six subjects of mutual interest have been selected and briefly described in the application in the following terms.

5.1. Curricula in European civil engineering education at undergraduate level

The primary objective of this sub-theme is to make a survey on curricula in civil engineering, both short cycle curricula (three-four years) and long cycle curricula (five years) in order to define the place given to various groups of subjects, to assess both the structural as well as the content aspects and to identify ways of increasing the compatibility of existing curricula across Europe. A monograph on European civil engineering education, the first of this kind, will be issued, together with recommendations for improving the co-operation between various types of institutions offering civil engineering education, for implementing credits accumulation and transfer systems etc.

5.2. Postgradute programmes and continuing professional development in civil engineering

The main objective of this sub-theme is to investigate thoroughly different forms of postgraduate education in civil engineering education, as an intrinsic part of the continuing professional development programme of graduates of different schools. Areas for establishing joint programmes and specialised courses will be defined. A special attention will be paid to matters related to continuing education and training in the construction industry of Europe at all levels, considering both the structure of the industry and the characteristics of the market.

5.3. Quality assessment and accreditation in civil engineering education

A first objective of this sub-theme is to collect data from all partner institutions in order to produce a state-of-the art of types and methods of quality assessment in civil engineering education applied in various countries. This will create a sound basis for debate and for search of solutions to be recommended.

Another objective of the sub-theme is to examine problems of accreditation, both academic and professional.

5.4. Innovation in teaching and learning in civil engineering education

The major objective of the sub-theme is to identify and disseminate best practice to improve teaching and learning in civil engineering education.

A survey will be made of both existing and new pedagogical methods such as case study, problem-solving and distance and open learning. The use of new information technology and new media technologies to both first degree diploma and life-long learning processes will be investigated. Challenges, such as the implementation in university syllabuses of the concepts and methods introduced by structural Eurocodes, will be also considered.

The sub-theme will encourage debate on the range of skills a civil engineering graduate for the 21st century will need and on the educational methods to be used for equipping students with such skills.

5.5. Synergy university-research-industry-public authorities in the construction sector of Europe

The sub-theme is aimed at defining the role of European civil engineering schools in the development, dissemination and exchange of scientific and technological knowledge, and of ideas relating to all aspects of construction. At the same time, the sub-theme will emphasize the synergy university-research-industry-public authorities as a basic requirement for the increase of the extent and effectiveness of construction research, technical and process development as well as innovation.

5.6. Demands of the economic and professional environments in Europe in respect to civil engineering education

The main goal of this sub-theme is to obtain the views of a significant number of academics and representatives of the construction industry, public authorities and professional associations on the future of civil engineering education in Europe, in particular on the objectives of this education and on the quality of its provision. These views are essential for defining in the case of civil engineering the main components of the higher engineering education: knowledge, know-how, understanding and skills.

6. The management of the project

The general administration of TNP - EUCEET and its financial matters are handled by Ecole Nationale des Ponts et Chaussées Paris, which is the Contractor of the project.

The chief governing body of the TN - EUCEET is the **Steering Committee**, chaired by *Prof. Marie-Ange Cammarota*, from ENPC Paris, Coordinator of the project. The Steering Committee is responsible for all major policy decisions within the TNP - EUCEET.

The **Steering Committee** consists of 13 members, representing institutions which have been actively involved in the preliminary phase of EUCEET activities, namely: Ecole Nationale des Ponts et Chaussées Paris; Escuela Tecnica Superior de Ingenieros de Caminos, Canales y Puertos - ETSECCP, Universitat Politecnica de Catalunya; Escuela Tecnica Superior de Ingenieros de Caminos, Canales y Puertos - ETSECCP, Universidad Politecnica Madrid; City University London; National Technical University Athens; Institut National des Sciences Appliquees – INSA, Lyon; Instituto Superior Tecnico-IST, Lisbon; University of Porto; Association of European Civil Engineering Faculties - AECEF, Prague; Technical University of Civil Engineering – TUCE, Bucharest; Politecnico di Torino; Technical University Berlin; Imperial College London.

The day-to-day management of the TNP - EUCEET is insured by the **Executive Board** of the Steering Committee, made of:

Prof. Marie-Ange Cammarota, ENPC Paris, Coordinator
Prof. David Lloyd Smith, Imperial College London, Deputy Coordinator
Prof. Iacint Manoliu, TUCE Bucharest, Secretary General
Assoc. Prof. Nicoleta Rădulescu, TUCE Bucharest, deputy member

7. EUCEET in the first year

A chronology of the meetings which took place in the first year of the Project (1 September 1998 – 31 August 1999) is given in the table 3.

Table 3

EUCEET meetings in the 1st year	
7 December 1998, Paris	1st meeting of the Steering Committee
22-23 February 1999, Barcelona	1st EUCEET General Assembly
23 February 1999, Barcelona	1st meetings of the Working Groups A,B,C
23 February 1999, Barcelona	2nd meeting of the Steering Committee
2 July 1999, Turin	2nd meeting of the Working Group B
17 July, Dresden	2nd meeting of the Working Group C
26 July 1999, London	2nd meeting of the Working Group A
27 July 1999, London	3rd meeting of the Steering Committee

In what follows, details will be provided only for the meetings of the Steering Committee and for the General Assembly. Presentations concerning the meetings of the Working Group can be found in the reports prepared by the WGs for this volume.

In the table given in the annex I the attendance of the Steering Committee meeting is summarized.

7.1. The first meeting of the Steering Committee

The first meeting of the Steering Committee of the TNP EUCEET took place at the ENPC Paris, on Monday 7 December 1998. It was decided that in the first half of the 3-year planned duration of the project, activities of three working groups to be undertaken, namely:

WG A: Curricula in Civil Engineering Education at undergraduate level
(Chairman: Prof. Iacint Manoliu, TUCE Bucharest)

WG B: Quality assessment and accreditation in Civil Engineering Education
(Chairman: Prof. Jose Ferreira Lemos, University of Porto)

WG C: Synergies between university, research, industry and public authorities in the construction sector of Europe
(Chairman: Prof. Laurie Boswell, City University London).

It was also decided to call the 1st General Assembly of EUCEET partners on 22-23 February 1999 in Barcelona, hosted by ETSECCP Barcelona which celebrates in 1999 25 years of existence.

The Executive Board, the Chairmen of the WGs and the representative of ETSECCP Barcelona, prof. J.R. Casas, met again at ENPC on 29 January 1999 to discuss the terms of reference for the Working groups and to prepare the EUCEET General Assembly.

7.2. The 1st EUCEET General Assembly

The first TNP EUCEET General Assembly took place at the Universitat Politecnica de Catalunya, Escola Tecnica Superior d'Enginyers de Camins, Canals i Ports Barcelona, on 22-23 February 1999.

The call of the General Assembly in February 1999 proved to be essential for the success of the Project in its first year. Unlike other Thematic Networks Projects of "vertical" type (on Chemistry, Physics etc) which benefited of the links developed for the Erasmus Evaluation Conferences by Study Subject Area, except core members previously involved in joint Tempus activities, the vast majority of the EUCEET partners were for the first time put into such a network. Therefore, it was imperative to have a General Assembly organised at an early stage of the project, for a broad exchange of views among the partners on the general objectives of the project and of the working groups, for defining the best approaches in order to accomplish them.

The General Assembly was attended by 49 people from 19 countries representing 32 universities partners in the Project.

In the table given in the Annex II, the attendance of the General Assembly is given.

At the opening session, the General Assembly was greeted by Prof. Jaime Pages, Rector of the Universitat Politecnica de Catalunya, Prof. Antonio Aguado, Dean of the ETSECCP Barcelona and Prof. Marie-Ange Cammarota, ENPC Paris, Coordinator of the Project.

In the first plenary session, Prof. Iacint Manoliu, made a comprehensive presentation of the Project, covering topics such as : background of the project; structure of the consortium of partners; general aims and objectives; main approaches and concepts; management and organisation of the project. Informations were also provided on other Thematic Network Projects, EUCEET being one of the 42 SOCRATES TNPs currently operating as a distinct Action, 1D, within the framework of the Erasmus chapter on higher education.

At the Opening Session of the first EUCEET General Assembly in Barcelona.
From right to left: Prof. Marie – Ange Cammarota, ENPC Paris, EUCEET Coordinator,
Prof. Jaime Pages, Rector of UPC, Prof. Antonio Aguado, Dean of ETSCECCP Barcelona,
Prof. Iacint Manoliu, Secretary General of the EUCEET Steering Committee

In the same session, Prof. Günther Heitman from TU Berlin, an active member of the working group on Quality Assurance and Mutual Recognition of the Thematic Network H3E (Higher Engineering Education in Europe), presented to the participants the H3E Project, focusing on the debates and recommendations of the First European Workshop on Accreditation of Engineering Programmes held in December 1998 in The Hague.

In the second plenary session, participants were informed about the aims and activities of two trans-national organisations partners in the Project: the Association of European Civil Engineering Faculties and the European Council of Civil Engineers. The presentations were made by Prof. Josef Machacek, member of the Executive Board of AECEF and, respectively, Prof. Iacint Manoliu, member of the Task Force on Education of ECCE.

Plenary sessions in the first day were also devoted to general presentations on the objectives, working methods and deliverables of the three working groups, made by their respective chairmen.

The second day of the Assembly, started with parallel sessions, representing the first meeting of the newly constituted working groups. Plans of future activities were established.

Activities to be undertaken within the contractual period of the 1st year of the Project, related to the plan established by each working group, were presented by the three Chairmen in the plenary session organised at the end of the General Assembly.

7.3. Other meetings of the Steering Committee in the first year

The second meeting of the Steering Committee took place in the afternoon of 23 February 1999 after the closure of the General Assembly. It was approved to call the second EUCEET General Assembly for 18-20 May 2000. As for the venue, a proposal was received from the representative of the Engineering College Odense.

The next meeting of the Steering Committee was set up for 27 July 1999 at the Imperial College, London, following the meeting of the WG A.

In conclusion, members of the Steering Committee unanimously agreed that, despite the difficulties inherently generated by the fact that the grant allocated by the Commission did not reached the bank account of the Coordinator by the time the General Assembly took place, the EUCEET project made in Barcelona a very promising start.

The third meeting of the Steering Committee was hosted by the Imperial College, Department of Civil Engineering, on 27 July 1999.

In the first session of the meeting, the Coordinator, Prof. Marie-Ange Cammarota made a general presentation of the financial situation of the Project.

The Secretary General of the Steering Committee, Prof. Iacint Manoliu, presented the development of the project between the previous meeting in Barcelona and the London meeting, underlining a number of events (meetings, conferences) during which the TNP EUCEET was made known to the European civil engineering community.

Chairmen of the Working Groups A, B, C presented state-of-the art reports on the activities undertaken since the Barcelona meeting and on the decisions adopted in the second meeting held in July 1999. Plans for the continuation of the work were also presented and approved by the Steering Committee.

Invited to attend the meeting, Dr. B.S. Choo from the University of Nottingham, presented the project CASED, submitted for approval within the 5th Framework Programme of the EC, coordinated by his university and involving other European universities, among which three EUCEET partners: Universidad Politecnica Madrid, Technische Universität München and Technical University of Civil Engineering Bucharest.

Another guest speaker at the Steering Committee meeting was Diana Maxwell, Deputy Secretary of the ECCE (European Council of Civil Engineers), partner in the EUCEET network.

Diana Maxwell presented, as a “case study”, the main outcomes of a consultation undertaken in 1997-98 by a Commission nominated by the President of the Institution of Civil Engineers in U.K. among major and smaller specialist contractors, industry clients, local government, represented at Chairman, Chief Executive, Senior Partner, Principle Officer or Technical Director level. More than 50 leaders of businesses and senior figures in Local Government expressed their views on Civil Engineering education in U.K. showing, among others, that entry standards for many Universities are unacceptably low, that courses should be more broadly based-have significant management and financial content, that University education should be more closely integrated with work experience, that courses should be longer than three years etc. These views have been considered in the new course guidelines established by the Engineering Council to which Institution of Civil Engineers is a member.

In the discussion which followed, it was shown that the presentation made by Diana Maxwell represents a good introduction for the activity of the future Working Group F *"Demands of the economic and professional environments in Europe in respect to civil engineering education"*, in which the involvement of ECCE and of its members, and in first place the Institution of Civil Engineers, will be essential.

8. EUCEET in the second year

A chronology of the meetings which took place in the second year of the project (1 September 1999 – 31 August 2001) is given in the table 4.

Table 4

EUCEET meetings in the 2nd year	
10 December 1999, Bratislava	4th meeting of the Steering Committee
28 February 2000, Lyon	5th meeting of the Steering Committee
28-29 February 2000, Lyon	3rd meeting of the Working Group A
14 April 2000, Barcelona	3rd meeting of the Working Group B
14-15 April 2000, Porto	3rd meeting of the Working Group C
17 May 2000, Odense	6th meeting of the Steering Committee
18 May 2000, Odense	4th meetings of the Working Groups A, B, C
18-20 May 2000, Odense	2nd EUCEET General Assembly
20 May 2000, Odense	1st meetings of the Working Groups D, E, F
14 June 2000, Sinaia	2nd meeting of the Working Group D
7 July 2000, Thessaloniki	5th meeting of the Working Group C
20 July 2000, Prague	5th meeting of the Working Group B
20 and 22 July 2000, Prague	5th meeting of the Working Group A
21 July 2000, Prague	5th meeting of the Steering Committee

As for the first year, in what follows details will be provided only for the meetings of the Steering Committee and for the General Assembly. Presentations concerning the meetings of the Working Groups A, B and C can be found in the reports prepared by the WGs for this volume.

8.1. The 1st meeting in the 2nd year of the Steering Committee, Bratislava, 10 December 1999

The meeting was organised and hosted by the Slovak University of Technology. In the first session, Assoc. Prof. Jozef Dicky made a brief presentation of the Slovak University of Technology Bratislava and of the Faculty of Civil Engineering.

Prof. Marie-Ange Cammarota, Coordinator, informed the participants about the provisions of the contract received from the EC for the second year of the project. The main figures of the contract for 1999-2000 were presented in a table, in comparison with those corresponding to the contract for the first year.

Thus, the maximum grant allocated is 286,300 EURO as compared with 35,000 EURO in 1998-1999. The increase is particularly significant for the EUR 18 partners (from 90,000 to 210,000 EURO), due in part to the fact that the percentage financing for the EUR 18 countries increased from 34,13% to 45%. The total maximum additional aid for the associated countries increased from 45,000 EUROs to 76,300 EURO, due to the increase of the number of eligible partners from 8 to 16.

Participants were also informed about the Final Report for the first year which was prepared in Bucharest by Marie-Ange Cammarota, Iacint Manoliu and Nicoleta Rădulescu. From the point of view of the financial matters, the situation was summarized in the table 5.

Table 5

Eligible partners country / number	Amounts declared in the Final Report, in EURO		
	SOCRATES	CO-FINANCING	TOTAL
EUR18/34	65 614	137 360	202 974
CZ/3	12 402	11 998	24 400
HU/1	4 500	4 762	9 262
RO/4	23 277	33 230	56 507

Prof. Iacint Manoliu, Secretary General, presented the developments which took place since the previous meeting of the Steering Committee (27 July 1999, London). A letter of endorsement was received from the University of Nottingham. Included in the list of partners for the 3rd year of the project were also the University of Architecture, Civil Engineering and Geodesy from Sofia, Bulgaria and the Czech Chamber of Certified Engineers and Technicians, Prague, whose letters of endorsements came after the submission of the Reapplication Form for the second year.

Prof. J. F. Lemos, Chairman of the Working Group B informed the participants about the activity of the Group, which is dealing with two distinct matters: Accreditation and Quality Management.

For the Working Group C, the information was presented by Prof. L. Boswell, Chairman of the WG. The questionnaire concerning synergies between university, research, industry and public authorities in the construction sector of Europe, distributed after the previous meeting of the WG (Dresden, 17 July 1999) already brought a promising number of responses.

Prof. Iacint Manoliu, Chairman of the Working Group A made a brief overview of the answers to the questionnaire on the undergraduate curricula in civil engineering education, including the amendments introduced at the previous meeting of the WG (London, 26 July 1999) concerning the division of subjects in the curricula in a number of 7 curricular categories.

In the second session, proposals for the transition from the second to the third year of the project and for the activities in the third year, to be included in the Renewal Form due to arrive in Brussels by 1st March 2000, were also discussed. In the first months of 2000, efforts shall concentrate on the activity at the level of the Working Groups and on the preparations for the second General Assembly, to take place in Odense, Denmark, on 18-20 May 2000.

A general scheme of the activities to take place between the Bratislava meeting and the end of the project (31 August 2001) was presented, approved and is enclosed in figure 3.

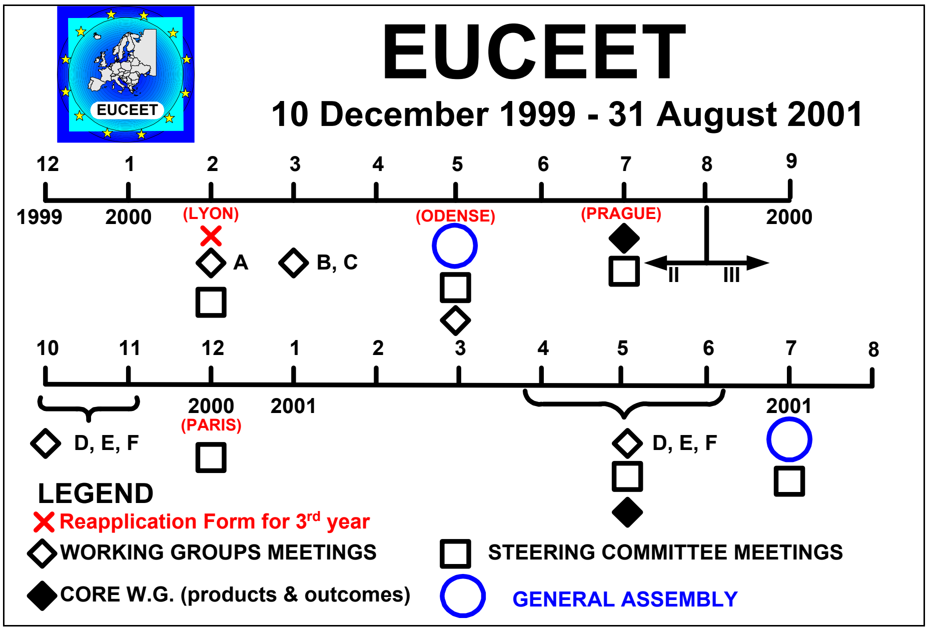


Figure 3

The next point on the Agenda was the nomination of the chairpersons for the Working Groups D, E and F:

For the Working Group D *"Postgraduate programmes and continuing professional development in civil engineering"*, Prof. Iacint Manoliu from the Technical University of Civil Engineering Bucharest was nominated as Chairman.

For the Working Group E (*"Innovation in teaching and learning in civil engineering education"*), Prof. Patrick Holmes from the Department of Civil Engineering at Imperial College, London was nominated as Chairman.

For the Working Group F (*"Demands of the economic and professional environments in respect to civil engineering education"*) M. François-Gerard Baron, ex-President of the European Council of Civil Engineers, was nominated as Chairman.

Attending the meeting, at the invitation of the Steering Committee,

M. François-Gerard Baron made a presentation of the aims and structure of ECCE and stressed the willingness of the Council and of its members to support the activity of the Working Group F and to contribute to the success of the Project EUCEET.

8.2. The 2nd meeting in the 2nd year of the Steering Committee, Lyon, 28 February 2000

The meeting was attended by the members of the Steering Committee representing Ecole Nationale des Ponts et Chaussées Paris, Imperial College London, Technical University London, ETSICCP Madrid, Politecnico di Torino, City University London, INSA Lyon, T.U. Berlin, ETSICCP Barcelona and AECEF.

The meeting was also attended by the chairpersons of the Working Groups E and F, nominated in Bratislava and by observers representing a large number of partner institutions (see the table in Annex I).

Prof. Iacint Manoliu, Secretary General of the Steering Committee, presented a Report on the meeting of coordinators of the Erasmus Thematic Network projects which took place in Brussels on 23 January, 2000. The most important thing, as far as EUCEET is concerned, was that the action called Thematic Network will be present also in the phase II of SOCRATES programme (2000-2004). During that period of time, existing Thematic Network projects will have the possibility, after the end of the 3-year contractual period, to continue to function for 12 months, for dissemination of the outcomes obtained, or for another 3 years, provided applications prepared in due time will be successful.

Assoc. Prof. Nicoleta Rădulescu, deputy member of the Executive Board, made a brief review of the provisions of the Renewal Form for the 3rd year of the project which was prepared in Bucharest by Prof. Marie-Ange Cammarota, Prof. Iacint Manoliu and Assoc. Prof. Nicoleta Rădulescu and sent to Brussels and also to all partners.

Prof. Iacint Manoliu (Technical University of Civil Engineering Bucharest), Chairman of the Working Group D *"Postgraduate programmes and continuing professional development in civil engineering"* presented the Terms of reference for the WG D. As in the case of the Working Group A, the main objective of the WG D is to conduct a Survey by using a comprehensive Questionnaire to be launched at the General Assembly in Odense.

Prof. Patrick Holmes (Imperial College London) presented the Terms of reference for the Working Group E *"Innovation in teaching and learning in civil engineering education"*. Prof. Holmes referred also to his experience in a Working Group of another Thematic Network project (H3E – Higher Engineering Education in Europe), which ended in August 1999.

Mr. François-Gérard Baron, ex-President of ECCE (European Council of Civil Engineers), presented the Terms of reference for the activity of the

Working Group F *"Demands of the economic and professional environments in respect to civil engineering education"*. He stressed the need to involve in this activity not only the representatives of academic institutions and professional associations partners in the Thematic Network but also representatives of a number of trans-European organisations, grouping the associations of contractors, of consulting engineers, of building professionals etc.

8.3. The 3rd meeting in the 2nd year of the Steering Committee, Odense, 17 May 2000

The meeting took place in the eve of the Second EUCEET General Assembly and had only one item on the agenda: final preparation for the Second EUCEET General Assembly.

8.4. The EUCEET Second General Assembly, Odense, Denmark, 18-20 May 2000

The EUCEET Second General Assembly took place on 18-20 May 2000 in Odense, organised and hosted by The Engineering College of Odense.

The Assembly was attended by 68 participants representing 44 institutions partners in the project (see table in Annex II).

In the first plenary session, Prof. Soren Ahle Hansen, Head of the Civil Engineering Department of The Engineering College Odense, made a welcome address.

Prof. Marie-Ange Cammarota, Coordinator, from the Ecole Nationale des Ponts et Chaussées Paris, presented the report *"EUCEET between Barcelona and Odense"*, informing the participants on the evolutions occurred since the first General Assembly in respect to the size and the composition of the network, the support received from the commission and the co-financing.

Prof. Marie-Ange Cammarota

Prof. Iacint Manoliu

A lecture entitled *"Civil Engineering in the context of the European higher education area – the role of EUCEET"* was presented by Prof. Iacint Manoliu, from the Technical University of Civil Engineering Bucharest, Secretary General of the EUCEET Steering Committee. Un updated version of the lecture is included in this volume.

The plenary session chaired by Prof. Richard Kastner (INSA Lyon) was devoted to the presentation and discussions on two reports prepared by the Working Group A on the basis of the responses received at the Questionnaire on undergraduate civil engineering education in Europe. One report was devoted to matters related to the organization of studies (name of the academic degree, calendar information, entry requirements, progress of students, examinations, final assessment, credits etc). The second report dealt with various aspects concerning curricula for programmes of short (3-4 years) and long (4.5–5–6 years) duration, with emphasis put on the distribution of the total number of contact hours between the eight categories of subjects. Both reports, in preliminary form, were prepared by Prof. Iacint Manoliu and Assoc. Prof. Tudor Bugnariu from the Technical University of Civil Engineering Bucharest.

The plenary session chaired by Prof. Josef Machacek (Czech Technical University Prague) was devoted to the presentation and discussions on two papers prepared by the Working Group B.

Prof. Ferreira Lemos (University of Porto) presented the paper on Accreditation for Engineering Courses.

Prof. Manfred Federau (The Engineering College Odense) presented the paper on Quality Management in Civil Engineering Educational Institutions.

Prof. Pericle Latinopoulos (Aristotle University of Thessaloniki) chaired the plenary session devoted to the Working Group C.

Prof. Laurie Boswell (City University London) presented the Report on "Synergies between University, Research, Industry and Public Authorities in the Construction Sector of Europe" based on the survey undertaken by the WG C amongst the partners in the network. The next three plenary sessions were devoted to the new Working Groups D, E, F.

In the plenary session chaired by Prof. Stanislaw Majewski (Silesian University of Technology Gliwice) Prof. Iacint Manoliu, Chairman of the Working Group D, presented the Terms of reference proposed for the WG D, including a draft of a questionnaire on postgraduate programmes in civil engineering education in Europe.

In the plenary session chaired by Prof. Bruce Misstear (Trinity College Dublin), Prof. Patrick Holmes, Imperial College London, chairman of the Working Group E, presented the terms of reference proposed for the WG E.

In the plenary session chaired by Prof. Aarne Jutila (Technical University Helsinki), M. François-Gerard Baron (European Council of Civil Engineers) chairman of the Working Group F, presented the terms of reference proposed for the WG F.

Presentations made by the chairpersons of the three Working Groups were followed by lively discussions, during which very constructive proposals for improving the terms of reference were made.

The third and last day of the General Assembly started with parallel sessions during which the participants distributed among the three new Working Groups D, E, and F.

In the closing plenary session, chairpersons of the Working Groups D, E, and F presented the activity plan of the WG based on the discussions and proposals made during the plenary session and on the decisions adopted in the first meeting of the newly constituted WG.

8.5. The 4th meeting in the 2nd year of the Steering Committee, Prague, 21 July 2000

The meeting was organised and hosted by the Czech Technical University and was attended by the members of the Steering Committee representing Ecole Nationale des Ponts et Chaussées Paris, Technical University of Civil Engineering Bucharest, Imperial College London, City University London, ETSICCP Madrid, T.U. Berlin, University of Porto, INSA Lyon and AECEF as well as by other representatives of the partner institutions (see Annex II).

A report on the financial situation of EUCEET in the 2nd year, prepared by Prof. Marie-Ange Cammarota and Assoc. Prof. Nicoleta Rădulescu, was presented, in view of the Final Report for the second year due to be sent to the commission by 30 September 2000.

The third and last day of the General Assembly started with parallel sessions during which the participants distributed among the three new Working Groups D, E, and F.

In the closing plenary session, chairpersons of the Working Groups D, E, and F presented the activity plan of the WG based on the discussions and proposals made during the plenary session and on the decisions adopted in the first meeting of the newly constituted WG.

8.5. The 4th meeting in the 2nd year of the Steering Committee, Prague, 21 July 2000

The meeting was organised and hosted by the Czech Technical University and was attended by the members of the Steering Committee representing Ecole Nationale des Ponts et Chaussées Paris, Technical University of Civil Engineering Bucharest, Imperial College London, City University London, ETSICCP Madrid, T.U. Berlin, University of Porto, INSA Lyon and AECEF as well as by other representatives of the partner institutions (see table in Annex II). A report on the financial situation of EUCEET in the 2nd year, prepared by Prof. Marie-Ange Cammarota and Assoc. Prof. Nicoleta Rădulescu, was presented, in view of the Final Report for the second year due to be sent to the commission by 30 September 2000.

1. Manfred Federau (DK); 2. Marie-Ange Cammarota (FR); 3. Soren Ahle Hansen (DK); 4. Nicoleta Radulescu (RO); 5. Josef Machacek (CZ); 6. Vaclav Kuraz (CZ); 7. Hynek Sertler (CZ); 8. Alois Materna (CZ); 9. Ladislav Lamboj (CZ); 10. Vincentas Stragys (LT); 11. Povilas Vainiunas (LT); 12. Antal Lovas (HU); 13. Gyorgy Kovacs (HU); 14. Istvan Bodi (HU).

15. Iacint Manoliu (RO); 16. Josef Dicky (SK); 17. Ludovit Fillo (SK); 18. Dusan Petras (SK); 19. Stanislaw Majewski (PL); 20. Ryszard Kowalczyk (PT); 21. Elzbieta Urbanska (PL); 22. Iuliu Dimoiu (RO); 23. Paulica Raileanu (RO); 24. Richard Kastner (FR); 25. Leone Corradi (IT); 26. Toomas Laur (EE); 27. Aarne Jutila (FI); 28. Bruce Misstear (IE); 29. Ghislain Fonder (BE); 30. Giovanni Barla (IT); 31. Dusan Katunsky (SK); 32. Miron Pavlus (SK); 33. Juris Smirnovs (LT); 34. Juris Naudznus (LV); 35. Tudor Bugnariu (RO); 36. Jose-Luis Juan-Aracil (ES); 37. David LLoyd-Smith (UK); 38. Colin Kerr; 39. Laurie Boswell (UK); 40. Wojciech Gilewski (PL)

25. Leone Corradi (IT); 29. Ghislain Fonder (BE); 33. Juris Smirnovs (LV); 34. Juris Naudznus (LV); 36. Jose-Luis Juan-Aracil (ES); 37. David LLoyd-Smith (UK); 38. Colin Kerr (UK); 39. Laurie Boswell (UK); 41. Bjarne Jensen (DK); 42. George Barsan (RO); 43. Dan Stematiu (RO); 44. Petre Patrut (RO); 45. Pedro Seco e Pinto (PT); 46. Jose Ferreira Lemos (PT); 47. Jean Paul Mizzi (FR); 48. Ban Seng Choo (UK); 49. Demos Angelides (GR); 50. Pericles Latinopoulos (GR); 51. Alan Kwan (UK); 52. Pedro Diez (ES); 53. Helena Wasmus (NL); 54. Ralf Reinecke (DE)

Prof. Marie-Ange Cammarota informed about the bid organized for the publication of the first EUCEET volume. Offers were received from companies in France, Spain, Denmark and Romania.

On the basis of the best offer in compliance with the term of reference, the Steering Committee decided to entrust the publication of the volume to a Bucharest based publishing house.

The Chairpersons of the Working Groups A, B, and C informed about the last meetings of the respective WG.

The Steering Committee discussed the proposal presented by Prof. Iacint Manoliu, the Secretary General of the Steering Committee, on the table of content for the first EUCEET volume which will contain the papers, reports and studies prepared by the Working Groups A, B, C as well as the materials presented in the opening plenary session of the General Assembly in Odense. The Steering Committee nominated as editor of the volume Prof. I.Manoliu.

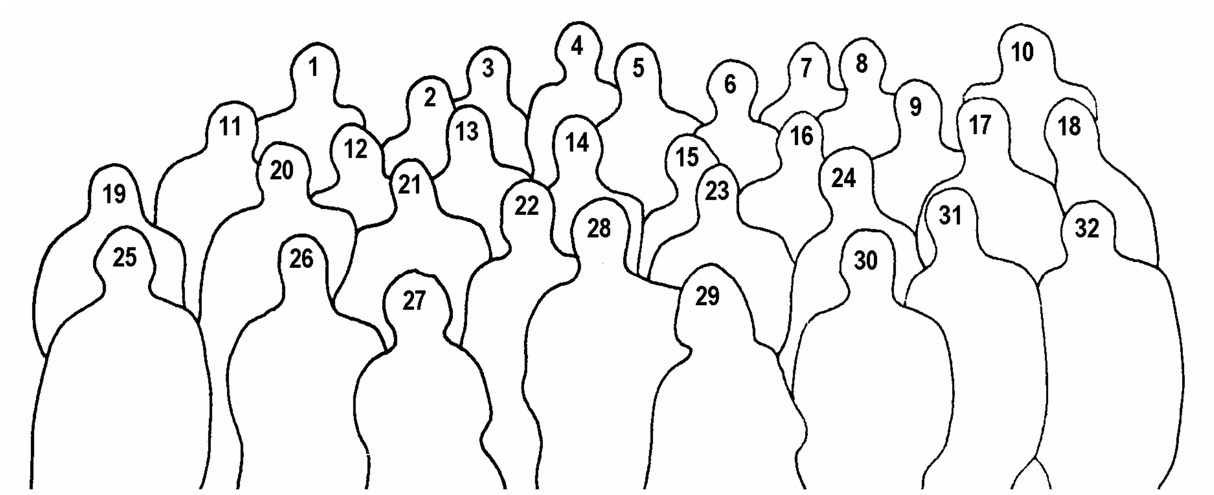
Prof. Iacint Manoliu presented the draft of the First announcement and call of papers for the EUCEET-ECCE Conference *"Challenges to the civil engineering profession in Europe at the beginning of the new millennium"* which is planned to take place in Romania in July 2001, before the third EUCEET General Assembly. Several proposals were made requiring a new version to be discussed with ECCE and with the chairman of the Working Group F, which will be in first place involved in finalising the programme of the Conference.

9. Financial situation of EUCEET

The table 6 summarizes the financial situation of EUCEET in the first two years, specifying for the group called EUR18 (countries belonging to EU and to EEA) and separately for each associated country the grant allocated by the European Commission through the SOCRATES programme and the sums actually spent.

Table 6

	First year 01/09/1998-31/08/1999		Second year 01/09/1999-31/08/2000	
	Socrates Grant	Spent	Socrates Grant	Spent
TOTAL	135.000	92.621	286.300	207.383
EUR18	90.000	52.684	210.000	135.003
CZ	13.500	12.160	16.000	16.000
HU	4.500	4.500	4.400	4.279
RO	27.000	23.277	28.000	26.582
LT	-	-	4.400	4.400
LV	-	-	4.400	3.516
PL	-	-	8.800	8.803
SK	-	-	8.800	8.800
SL	-	-	1.500	0



1. Jiri Vaska (CZ); 2. Hynek Sertler (CZ); 3. Laurie Boswell (UK); 4. Bruce Misstear (IE); 5. Vincentas Stragys (LT); 6. Juris Naudznus (LV); 7. Colin Kerr (UK); 8. Dusan Katunsky (SK); 9. Richard Kastner (FR); 10. Antal Lovas (HU); 11. Jozef Dicky (SK); 12. Yveta Linhartova (CZ); 13. Ludovit Fillo (SK) 14. Ghislain Fonder (BE); 15. Stefan Bergman (DE); 16. Vaclav Kuraz (CZ); 17. Tudor Bugnariu (RO); 18. Wojciech Gilewski (PL); 19. Istvan Bodi (HU); 20. Alois Materna (CZ); 21. Jose Fereira Lemos (PT); 22. Jose-Luis Juan-Aracil (ES); 23. Manfred Federau (DK); 24. Alan Kwan (UK); 25. Josef Machacek (CZ); 26. David Lloyd-Smith (UK); 27. Marie-Ange Cammarota (FR); 28. Iacint Manoliu (RO); 29. Nicoleta Radulescu (RO); 30. Stanislaw Majewski (PL); 31. Ryszard Kowalczyk (PT); 32. Andrzej Lapko (PL);

10. EUCEET and the economic and professional environments

A very important feature of EUCEET is that 13 professional associations, representing the civil engineering profession from U.K., Germany, France, Italy, Greece, Portugal, Spain, Ireland, Romania, Czech Republic, Slovakia, Cyprus and one trans-national professional association (ECCE) are also partners in EUCEET.

There is no need to demonstrate the relevance of the participation of professional associations to EUCEET. Representatives of 59 European universities offering civil engineering education, as well as of the two academic associations (of Faculties of Civil Engineering and of civil engineering students) have the possibility of learning about these associations, their goals and accomplishments. The professional associations and in first place the European Council of Civil Engineers - ECCE which groups them at European level, should play a leading role in the activity of the Working Group in charge of the sub-theme **"Demands of the Economic and Professional Environments in Europe in Respect to Civil Engineering Education"**. Activities of this Working Group, were launched in May 2000, at the second EUCEET General Assembly. The International Conference on the **"Challenges to the Civil Engineering Profession in Europe at the Beginning of the New Millennium"**, to take place on 13-15 July 2001 in Romania, jointly organised by the Technical University of Civil Engineering of Bucharest and the Union of Associations of Civil Engineers of Romania under the auspices of EUCEET and ECCE, represents a major objective of this Working Group. The Conference will bring together representatives of the academic world, of the professional associations, of the industry, of the public authorities etc., providing a unique forum for discussions among persons interested in European civil engineering profession.

11. Conclusions

The success of the activities undertaken in the first two years (1998-1999 and 1999-2000) in the frame of the SOCRATES Thematic Network Project EUCEET justifies the confidence in the accomplishment of the numerous and generous goals of the project. This success could not have been obtained without the enthusiastic participation of the partners who contributed to build and to strengthen the EUCEET network.

Annex I

Members of the Steering Committee										
Crt No	NAME	INSTI-TUTION	CN TR	ATTENDANCE OF THE MEETINGS						
				PARIS	BARCE LONA	LON-DON	BRATI-SLAVA	LYON	ODEN-SE	PRA-GUE
				7.12. 1998	23.02. 1999	27.07. 1999	10.12. 1999	28.02. 2000	17.05. 2000	21.07. 2000
1	Joseph MACHACEK	AECEF	CZ	X		X	X	X	X	X
	(Manfred Federau*)	AECEF			X					
2	Stavros SAVIDIS	T.U. Berlin	DE	X						
	(Jorg FRANKE*)	T.U. Berlin			X			X	X	X
	(Stefan BERGMAN*)	T.U. Berlin				X				
3	Jose Luis Juan ARACIL	E.T.S.I.C.C.P. Madrid	ES	X	X	X	X	X	X	X
4	Juan Ramon CASAS	E.T.S.E.C.C.P	ES	X	X	X		X		
	(Pedro DIEZ*)	Barcelona								
5	Marie-Ange Cammarota	E.N.P.C. Paris	FR	X	X	X	X	X	X	X
6	Richard KASTNER	I.N.S.A. Lyon	FR	X	X	X	X	X	X	X
7	Efrossini KALKANI	N.T.U. Athens	GR							
8	Giovani BARLA	Politecnico di Torino	IT	X		X		X	X	
	(Giuseppe MANCINI*)	Politecnico di Torino								
9	Jose Ferreira LEMOS	University of Porto	PT	X	X	X	X		X	X
10	Pedro MENDES	I.S.T. Lisbon	PT	X		X				
	(Joao Hipolito*)	I.S.T. Lisbon								
11	Iacint MANOLIU	T.U.C.E.Buch.	RO	X	X	X	X	X		X
12	David Lloyd SMITH	Imperial College London	UK	X	X	X	X	X		X
13	Laurie BOSWELL	City University of London	UK	X	X	X	X	X		X
Other Participants										
14	Ghislain FONDER	University of Liege	BE							X
15	Alois MATERNA	Czech Chamber of Engineers Prague	CZ				X			
16	Ralf REINECKE	T.U. Munich	DE					X		
17	Manfred FEDERAU	Engineering College of Odense	DK					X		X
18	François-Gerard BARON	E.C.C.E	FR				X	X		X
19	Antal LOVAS	T.U. Budapest	HU	X		X	X	X		X
20	Istvan BODI	T.U. Budapest	HU			X				X
21	Gyorky FARKAS	T.U. Budapest	HU				X			
22	Vincentas STRAGYS	Vilnius Gediminas Technical University	LT				X			X
23	Helena WASMUS	T.U. Delft	NL					X		
24	Eivind BRATTELAND	Norwegian University of Science & Technology	NO					X		

Crt No	NAME	INSTI-TUTION	CN TR	ATTENDANCE OF THE MEETINGS						
				PARIS	BARCE LONA	LON-DON	BRATI-SLAVA	LYON	ODEN-SE	PRA-GUE
				7.12. 1998	23.02. 1999	27.07. 1999	10.12. 1999	28.02. 2000	17.05. 2000	21.07. 2000
25	Stanislaw MAJEWSKI	Silesian University of Technology Gliwice	PL				X	X		X
26	Wojciech GILEWSKI	Warsaw University of Techn.	PL							X
27	Audnej EAPKO	Bialystok Technical University	PL							X
28	Riczard KOWALCZYK	University of Beira Interior Covilha	PT					X		X
29	Nicoleta RĂDULESCU	T.U.C.E. Bucharest	RO	X	X	X	X	X	X	X
30	Jana TOMKOVA	Slovak Univ. of Techn. Bratislava	SK	X			X			
31	Jozef DICKY	Slovak University of Techn. Bratislava	SK			X	X			
32	Dusan KATUNSKY	T.U. Kosice	SK							X
33	Colin KERR	Imperial College London	UK	X	X	X	X	X		X
34	Ban Seng CHOO	Nottingham University	UK		X			X		
35	Patrick HOLMES	Imperial College London	UK					X		
36	Alan KWAN	Cardiff School of Engineering	UK							X

Annex II

Attendance of EUCEET General Assemblies*

Crt Nr.	NAME	INSTITUTION	CNTR	Attendance of the GA	
				BARCELONA	ODENSE
				22-23.02.1999	18-20.05.2000
1	Jean-Francois THIMUS	Université Catholique de Louvain	BE	X	
2	Ghislain FONDER	University of Liege	BE	X	X
3	Vaclav KURAZ	Czech Technical University Prague	CZ	X	X
4	Ladislav LAMBOJ	Czech Technical University Prague	CZ		X
5	Josef MACHACEK	Czech Technical University Prague	CZ	X	X
6	Alois MATERNA	Brno University of Technology	CZ		X
7	Hynek SERTLER	University of Pardubice	CZ	X	X
8	Ulvi ARSLAN	T.U. Darmstadt	DE		X
9	Ralf REINECKE	T.U. Munchen	DE	X	X
10	Jorg TRONLU	T.U. Berlin	DE	X	
11	Heilmann GUNTHER	T.U. Berlin	DE	X	
12	Peter RUGE	T.U. Dresden	DE	X	
13	Manfred FEDERAU	Engineering College of Odense	DK	X	X
14	Shren Ahle HANSEN	Engineering College of Odense	DK		X
15	Christian Bjarne JENSEN	Engineering College of Odense	DK		X
16	Konstantin LASSITHIOTAKIS	Engineering College of Odense	DK		X
17	Toomas LAUR	T.U. Tallinn	EE		X
18	Joan CASAS	Universidad Politecnica de Catalunya	ES		X
19	Jose-Luis JUAN-ARACIL	Universidad Politecnica de Madrid	ES	X	X
20	Francesc ROBUSTE	Universidad Politecnica de Catalunya	ES	X	
21	Juan MURCIA	Universidad Politecnica de Catalunya	ES	X	
22	Aarne JUTILA	Helsinki University of Technology	FI	X	X
23	Francois-Gerard BARON	ECCE	FR		X
24	Marie-Ange CAMMAROTA	E.N.P.C Paris	FR	X	X
25	Richard KASTNER	I.N.S.A. Lyon	FR	X	X
26	Amaury LEGAIT	E.N.P.C. Paris	FR		X
27	Jean Paul MIZZI	E.N.T.P.E. Lyon	FR		X

28	Jean Michel TORRENTI	E.N.P.C. Paris	FR	X	
29	Jacques LERAU	I.N.S.A. Toulouse	FR	X	
30	Carolin TRINKS	T.U. Dresden	GE		X
31	Demos ANGELIDES	Aristotle University of Thessaloniki	GR		X
32	Pericles LATINOPOULOS	Aristotle University of Thessaloniki	GR	X	X
33	Istvan BODI	T.U. Budapest	HU	X	X
34	Gyorgy FARKAS	T.U. Budapest	HU		X
35	Antal LOVAS	T.U. Budapest	HU	X	X
36	Bruce MISSTEAR	Trinity College Dublin	IE	X	X
37	Giovanni BARLA	Pilotecnico di Torino	IT	X	X
38	Leone CORRADI	Politecnico di Milano	IT		X
39	Roberto CONTORO	Politecnico di Milano	IT	X	
40	Vincentas STRAGYS	T.U. Vilnius Gediminas	LT	X	X
41	Povilas VAINIUNAS	T.U. Vilnius Gediminas	LT	X	X
42	Juris Richards NAUDZUNS	T.U. Riga	LV		X
43	Juris SMIRNOVS	I.T.I.E. Riga	LV		X
44	Ellen TOUW	T.U. Delft	NL	X	X
45	Helena WASMUS	T.U. Delft	NL		X
46	Eivind BRATTELAND	Norwegian University of Science & Technology	NO	X	
47	Wojciech GILEWSKI	Warsaw University of Technology	PL		X
48	Andrzej LAPKO	T.U. Bialystok	PL		X
49	Stanislaw MAJEWSKI	Silesian University of Technology Gliwice	PL	X	X
50	Elzbieta URBANSKA-GALEWSKA	T.U. Gdansk	PL		X
51	Joao CASTRO GOMES	University of Beira Interior	PT		X
52	Ryszard KOWALCZYK	University of Beira Interior	PT	X	X
53	Julia LOURENCO	Universidade de Minho	PT		X
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* The alphabetical order of countries was adopted

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CIVIL ENGINEERING IN THE CONTEXT OF THE EUROPEAN HIGHER EDUCATION AREA - THE ROLE OF EUCEET

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1. Introduction

As it appears from the UNESCO's World Academic Data Base, there are more than 800 higher education institutions providing engineering education in the 44 European countries. It is reasonable to consider that at least one third of those institutions are offering also degree courses in civil engineering.

59 civil engineering schools in Europe became partners in a Thematic Network project put under the auspices of the SOCRATES-ERASMUS programme of the European Commission and called EUCEET (**EU**ropean **C**ivil **E**ngineering **E**ducation and **T**raining).

The scope of this paper (which represents an updated version of a lecture presented by the author at the EUCEET Second General Assembly, on 19 May 2000 in Odense) is to situate EUCEET in respect to the evolutions taking place in the higher education, in general, and in the civil engineering education, in particular, at European level, in first place, but also at a broader scale.

2. EUCEET and the SOCRATES programme

SOCRATES is the European Community programme in the field of education. In its first phase, SOCRATES I, from 1995 to 1999, the programme had 9 objectives, 27 actions and a budget of 0.9 billion ECU. In 1995, eligible countries were the 15 EU countries plus the three countries of the European Economic Area: Iceland, Liechtenstein and Norway. From 1 September 1998 a number of Associated countries became also eligible: Czech Republic, Slovakia, Poland, Hungary, Romania and Cyprus.

The higher education component of SOCRATES is Erasmus which, under SOCRATES I, provided three different types of support for European activities:

- Grants to Universities for activities within an Institutional Contract (Erasmus Action 1)
- Grants to Universities for activities outside the Institutional Contract (Thematic Network projects)
- Mobility Grants for students (Erasmus Action 2)

In 1998/99, the first year of existence of the Thematic Network project EUCEET, the budget of Erasmus was 116,25 million ECU (an increase of 18.8% as compared to 1997/98) the total number of eligible countries was 24 (as compared to 18 in 1997/98) and the total number of universities involved

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raised to 1600. Grants were given for mobility of 200.000 students and 35.000 teachers.

SOCRATES II was approved by the European Commission for a new five years term: 2000-2004.

Four objectives were defined for the new phase of the programme:

1. to strengthen the European dimensions in education at all levels
2. to promote educational cooperation in all sectors and at all levels
3. to help to help remove the obstacles to such cooperation
4. to encourage educational innovation in the community

The programme consists of eight actions (instead of 27 in the phase I) covering the three fundamental stages of lifelong learning:

1. school education (COMENIUS)
2. higher education (ERASMUS)
3. other educational pathways (GRUNDTVIG)
   but also:
4. teaching and learning languages (LINGUA)
5. education and multimedia (ATLAS)
6. observation and innovation (EURYDICE, ARION and NARIC)
7. joint actions
8. accompanying measures

From the eight above listed actions, three are new: No. 3, No. 5 and No. 7.

The budget for SOCRATES II is 1,4 billion EURO, marking a 50% increase in respect to SOCRATES I. The number of eligible countries also increased. The Baltic States and Slovenia became eligible from 1 September 1999, Malta and Turkey from 1 September 2000.

Inside Erasmus several changes occurred in SOCRATES II, too.

The most important, as far as EUCEET is concerned, is that Thematic Network projects are no longer activities outside the Institutional Contract, but they should be incorporated in the Institutional Contract of the coordinating institutions.

It is worth to situate EUCEET among other Thematic Networks funded by the European Commission so far. Data which will be given in what follows are taken from the working paper *"Changing the Universities: the supporting role of the Erasmus Thematic Network (a three-year perceptive)"* prepared for the European Commission by Dr. Philippe Ruffio [1].

The Erasmus chapter called *Thematic Network project* was initiated in 1996 for a set duration of three years, on the basis of renewable contracts according to standard open bid procedure, candidacy assessment and activity reports. The oldest Thematic Networks completed their three-year cycle in August 1999. In total, this action involved 43 activity projects corresponding to contracts respectively initiated in 1996/97 (24 contracts), 1997/98 (8), 1998/99 (9, among which EUCEET) and 1999/2000 (2). Areas and themes covered by the Thematic Networks are summarized in the Table 1.

Table 1

Areas and themes covered by the Thematic Networks

1 - Classical academic themes:

- *Economic, Social and Human Sciences*: archaeology, arts, law, teachers training, management, languages, literature, political science, communication science, sports.
- *Sciences and Technology*: biology, dentistry, chemistry, engineering, **civil engineering**, computer science, medicine, veterinary medicine, physics, agriculture and food sciences.

2 - Specialisation fields:

- Training to humanitarian development, women's studies, citizenship childhood, speech communication science, social professions, tertiary sector (social economics), tourism and leisure.
- Training to biotechnologies (two projects), electrical and information engineering, gerontechnology, water and environment management, environmental science, occupational therapy, pharmacology, medical physics and engineering, urban planning, adapted physical activity.

3 - Transversal Networks:

- Philosophy and human science, ethics, open and distance learning, continuing education, university management and administration.

As one can see, among the classical academic themes, there are only two networks belonging to engineering area. One is the H3E (Higher Engineering Education in Europe), a Thematic Network of the first generation (1996/97 – 1998/99) run jointly by three organizations: SEFI (Société Européenne pour la Formation des Ingénieurs), CESAER (Conference of European Schools for Advanced Engineering Education and Research) and BEST (Board of European Students of Technology). The second one is EUCEET.

The Thematic Networks associate two types of partners: higher education institutions on the one hand and a large number of varied organizations on the other.

The total number of higher education institutions participating in the Thematic Networks exceeds 5,500. On average, each Network involves 132 higher education institutions, ranging from forty to more than 400.

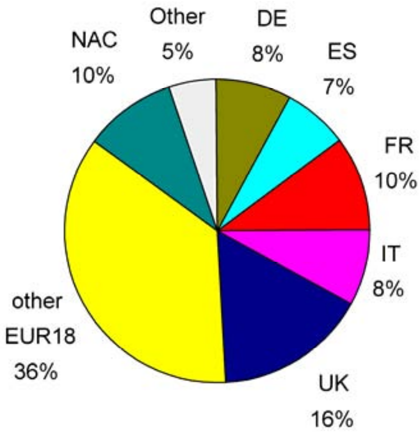
In the table 2 is given the Network distribution according to size (number of higher education institutions).

Table 2

Less than 75	75 – 150	150 - 225	More than 25	Total
9	21	8	5	43

With 49 higher education institutions partners in the year 1999/2000, to which the figures in the table 2 correspond, EUCEET is, obviously, a network of small size. However, as it was stressed several times in the Reports to the Commission, the Steering Committee considers that the strength of the network is based not on the size, reflected in the number of partners, but on the high level of the institutions involved and on their commitment to fulfill the objectives of the project.

The figure 1 shows the breakdown of total participation of higher education institutions and the figure 2 the breakdown of new associated countries participation. Both graphs refer to the situation in October 1999.



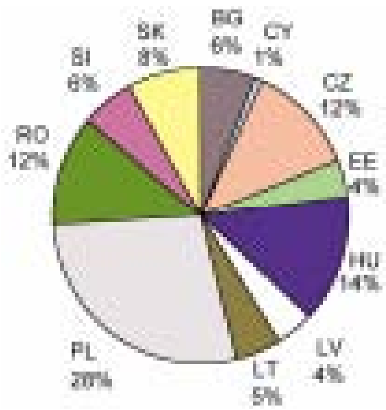
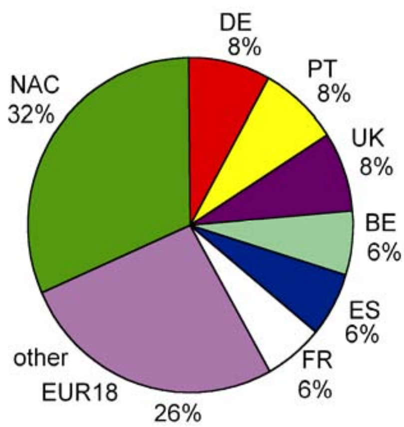


Figure 1 **Figure 2**

Legend: **NAC** = new associated countries; **Other** = other countries (European and non-European)

Figures 3 and 4 refer to the same breakdowns, but related to the EUCEET partners in the second year (1 September 1999 – 31 August 2000).



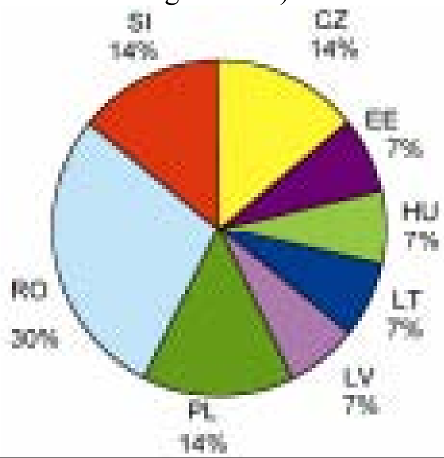


Figure 3 **Figure 4**

3. Towards a coherent European higher education space

3.1. The Sorbonne and Bologna Declarations

Diversity and complexity are the key-words to characterize higher education in Europe, as a direct result of major differences in factors as type, breadth and duration of secondary education, the existence of sub-systems of higher education (short duration and long duration programmes), access to higher education, systems of tuition fee, calendar of the academic year, frequency and type of examinations, number and type of degrees that can be earned etc.

Two official Declarations led in recent years to heat debates on the future of the higher education in Europe.

The first one was the Sorbonne Declaration of 25th May 1998 *"on harmonization of the architecture of the European higher education system"*, signed by the Ministers of Education of France, Germany, United Kingdom and Italy (see annex I).

The second one is the Bologna Declaration of 19th June 1999 *"on the European higher education area"*, signed by Ministers of Education of 29 European countries (see annex II).

The Sorbonne Declaration recommended that studies should be organized in two cycles: undergraduate and graduate, but did not provide an indication of their duration. So, implicitly rather than explicitly, the Sorbonne Declaration represented a plea in favour of a shift from the *"continental"* to the *"anglo-saxon"* system. An outstanding expert on European higher education matters, Guy Haug, Principal Advisor at the Association of European Universities (CRE) , has the following comments on the need for such a move in a state of the art report [2] which he prepared on behalf of the Confederation of European Union Rectors Conferences and of CRE, with the support of the European Commission, and presented at Bologna Conference on June 18, 1999, in the eve of the meeting of Ministers of Education of 29 European countries:

"What the British and the US system, as well as those of the numerous countries which took inspiration from them (in the Commonwealth, Latin America and Asia and more recently in former communist countries) all share in common is a basic structure differentiating undergraduate and (post)graduate studies. Their definition, organisation, content, respective role and size may be very different according to country and subject; the line of divide between them may be blurred and their articulation may be shifting. But the broad distinction between an undergraduate and a (post)graduate level is so widespread around the world that not also having it would make continental Europe an ever more isolated island of relative incompatibility. The Sorbonne Declaration was more than justified to promote a move in this direction".

The Sorbonne Declaration stated that a two-cycle system *"seems to emerge"* and *"should be recognized for international comparison and equivalence"*. It mentioned also the need to have first cycle degrees which are *"internationally recognized"* as *"an appropriate level of qualification"* and a graduate cycle *"with a shorter master's degree and a longer doctor's degree"* with possibilities to transfer from one to the other.

The debate that followed the Sorbonne Declaration focused on the alleged emergence of a European *"model"* with 3 main levels of qualifications requiring 3,5 or 8 years of study, as was proposed in the *"Attali report"*, which made recommendations for changes in the French system of higher education. On this model, Haug has the following comments:

"No significant convergence towards a 3-5-8 model was found. Whether traditional or newly introduced, bachelor-type degrees require 3 to 4 years, and many European countries without bachelors have first degrees in 4 years; there is however a high degree of convergence towards a duration of about 5 years for master-level studies; but there is no 8-year standard duration for doctoral degrees. In addition, whereas the UK, the US and most countries in the world – except in continental Europe – apply two-tier (undergraduate-postgraduate) systems, the length of studies and the degree structures vary considerably within and between these countries, and duration tends to be expressed in academic credits rather than in years".

Another aspect revealed by the Sorbonne Declaration was the challenge represented by the need for European higher education to retain its competitiveness in the world markets of knowledge production and dissemination. Also, the Sorbonne declaration is about *"qualifications"* (knowledge and skills acquired which can be applied in the labour market) rather than academic degrees.

A step forward for major changes in the European higher education system was made by the Bologna Declaration. It is worth to remind here the objectives considered to be, by the signatories of the Bologna Declaration, of primary relevance in order to establish the European area of higher education and to promote the European system of higher education world-wide:

- *Adoption of a system of easily readable and comparable degrees, also through the implementation of the Diploma Supplement.*
- *Adoption of a system essentially based on two main cycles, undergraduate and graduate. Access to the second cycle shall require successful completion of first cycle studies, lasting a minimum of three years. The degree awarded after the first cycle shall also be relevant to the European labour market as an appropriate level of qualification. The second cycle should lead to the master and/or doctorate degree as in many European countries.*
- *Establishment of a system of credits –such as in the ECTS system- as a proper means of promoting the most widespread student mobility.*
- *Promotion of mobility by overcoming obstacles to the effective exercise of free movement.*

• *Promotion of European co-operation in quality assurance with a view to develop comparable criteria and methodologies.*

• *Promotion of the necessary European dimensions in higher education, particularly with regards to curricular development, inter-institutional co-operation, mobility schemes and integrated programmes of study, training and research.*

As one can see, basic ideas of the Sorbonne Declaration can be found in the Bologna Declaration, but in a more specific way. A figure: three years is given this time for the minimum duration of the first cycle considered as a prerequisite for the access to the second cycle. A term is also set up to reach the defined objectives: before the end of the first decade of the third millennium.

Both Declarations referred to the *"European higher education system"* or to the *"European higher education area"* without reference to any specific field. It is, therefore, appropriate to take a closer look at the European engineering education and, in particular, at the civil engineering education, following the two Declarations.

3.2. Some changes in engineering education in Europe

As far as engineering education was concerned, only a few years ago things seemed to be quite simple. Two basic systems were present:

- the *"continental"* (or binary) system characterized by the coexistence, in most European countries, of two parallel types of engineering education: of long duration, with nominal duration in almost all cases of 5 years and of short duration, with nominal duration of 3…4 years;
- the *"anglo-saxon"* (or two-tier) system, with undergraduate courses leading to Bachelor of Engineering degree after 3 years (in England and Ireland) and 4 years (in Scotland), followed by postgraduate studies leading to a Master of Sciences degree (1-2 years)

In figure 5 are represented various types of education belonging to the *"continental"* system. There are two main features:

- the *"parallel"* system (a, b) which is most common, with the short duration programme 3-4 yrs and the long one of 5 yrs (rarely 6);
- the *"tree"*or *"y"* system (c, d) where the two programmes have a common trunk of 1-2 yrs, which was used in some Universität-Gesamthochschulen in Germany offering simultaneously engineering degree courses of short and of long duration.

In figure 6 are represented various types of education belonging to the anglo-saxon system (the *"ladder"* system). The first degree could be attained, depending on the school, after 3 or 4 yrs and can represent a BEng or MEng degree.

In recent years, changes have occurred in European engineering education, too.

For instance, a number of English universities, among which most notably Imperial College in London, ceased to offer BEng as a first degree and are offering instead a 4-year accredited Master of Engineering (M Eng) degree which is required by the Engineering Council as the educational base for the Chartered Engineer registration.

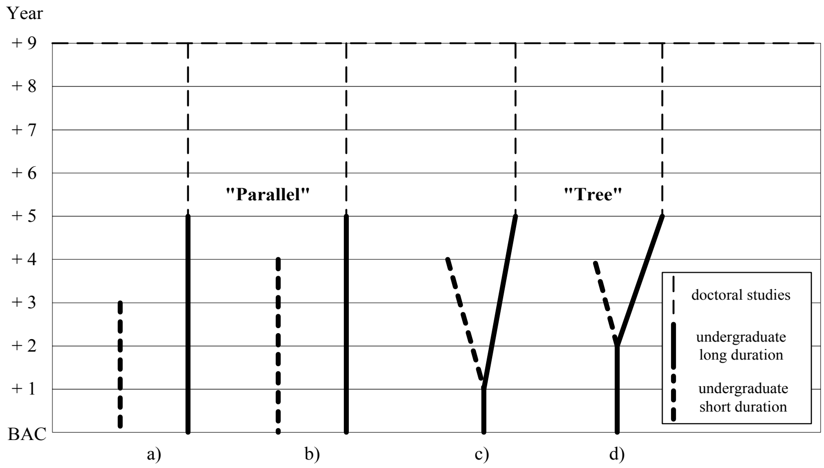


Figure 5

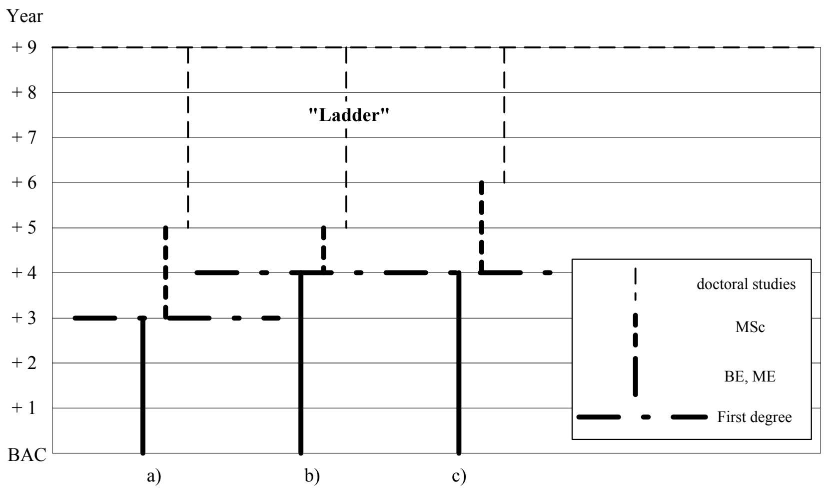


Figure 6

Speaking on the engineering education in U.K., one cannot ignore the important role played by the engineering Institutions in insuring engineering qualification. In the Standard route for registration (SARTOR), as defined by the Engineering Council in collaboration with engineering Institutions, including Institution of Civil Engineers and Institution of Structural Engineers [3], the accredited MEng degree course represents the educational base, to be followed by the Initial Professional Development and the Professional Review with Interview as a Final Test of Competence and Commitment in order to achieve the Registration as a Chartered Engineer.

The figure 7 shows the Main Routes to Registration, as presented in the SARTOR 3rd Edition [3].

As for the continental system, a most significant event occurred in Germany where an amendment to the federal law on higher education in 1998 allowed Universities and Fachhochschulen to set up new bachelor and master degrees. Bachelor courses may last from 6 to 8 semesters and master courses from 2 to 4 semesters; when offered as consecutive steps in a long curriculum their aggregate duration cannot exceed a total of 10 semesters. New courses may replace traditional ones or run in parallel, but no additional public money is provided.

A survey of the approximately 80 bachelor and master courses that were started in the autumn of 1998 shows that most courses are in science and technology and most use English only or in various combinations with German. Whether offered as separate programmes or as consecutive steps of a long programme, most bachelor are in 6 and most masters in 4 semesters, with various possibilities to earn a German *Diplom* on top of the bachelor or master degree, often after an additional period of study. The fact that most courses were offered in English is symptomatic and is related to one of the main reasons behind the 1998 law: the need to increase the attractiveness of the German universities for foreign students.

It should be noted in this context, as learned from a recent paper [4], that at its 56th Meeting, on 5-6 October 1999, the Conference of German Faculties of Civil Engineering (Fakultätentag), discussing the theme "*Internationalisation of study courses and improvement of the curriculum"*, adopted a *Resolution* which begins with the following recommendation:

"Existing study courses finalised with a Diploma have been tested and enjoy a general recognition. With theirs Basic studies (Grundstudium), Basic engineering studies (Grundfachstudium) and Specialized engineering studies (Vertiefungsstudium) they have an efficient, modern and clearly defined structure. The Diploma conferred by the universities is regarded on the international scale as a Diploma of high quality. There is no reason to give up and to replace existing Diploma study courses.

Existing Diploma study courses and Diploma-Projects should be maintained".

Nevertheless, for the sake of internationalisation, the *Resolution* includes a proposal reproduced in the figure 8 and called: "*Scheme to bring about a compatibility between diploma and bachelor master study courses in civil engineering at universities"*.

As shown in the Report of the EUCEET Working Group A included in the part II of this volume, where results of a Survey on curricula at undergraduate level in civil engineering are given, so far in no one of the 17 German higher education institutions (5 Universities and 12 Fachhochschulen), which responded to the questionnaires, were bachelor and master courses introduced in parallel with the traditional ones in the field of civil engineering.

In Austria an amendment to the law on higher education along similar lines as in Germany was adopted, allowing the introduction of bachelor courses on a voluntary basis in replacement of existing curricula, bachelor in 3-4 years but masters in 1 year, no extra funding. Here, again, the answer to the Survey received from T.U. Vienna shows that for the time being the continental system is preserved.

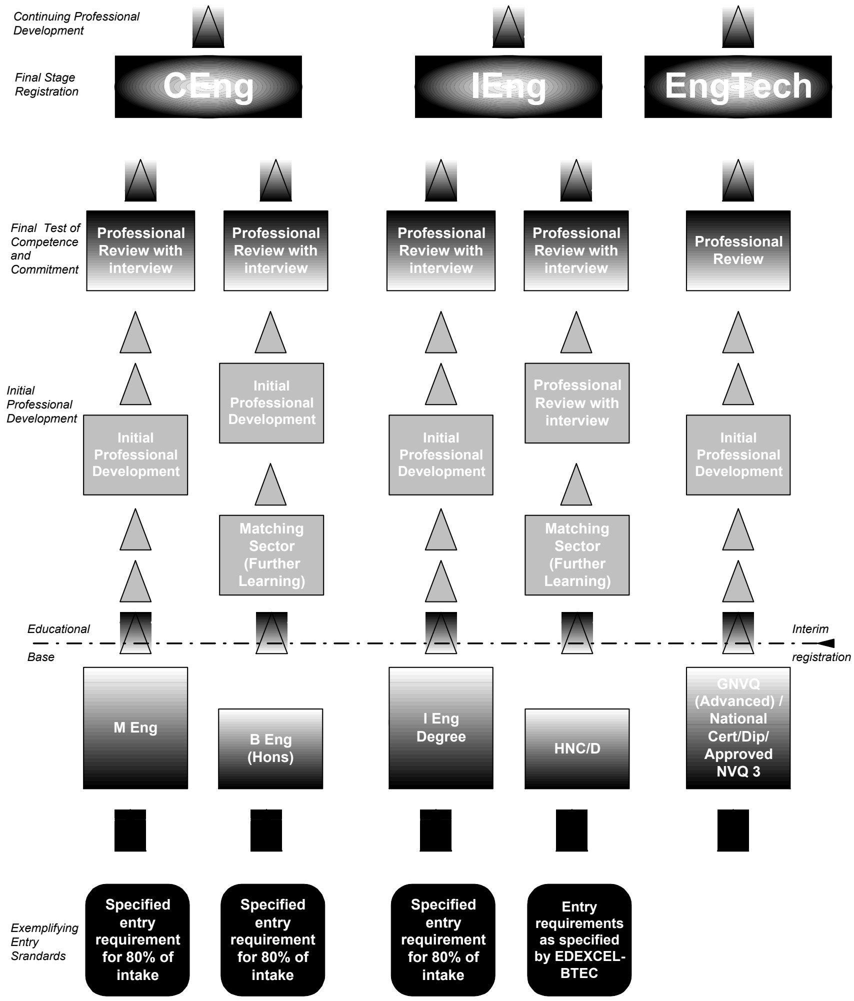


Figure 7

Italy seems to be the first country which introduced a major reform in line with the criteria defined in the agreement of Sorbonne and later in the Joint Declaration of Bologna. The new Regulation (*"Regolamento in materia di autonomia didattica degli Atenei"*) published in the Official Gazette no. 2 on 4th January 2000, introduces first level and second level titles: a diploma after three-year course (Laurea – 180 credits) and the two-year specialization course, following the first level diploma (Laurea Specialistica – further 120 credits).

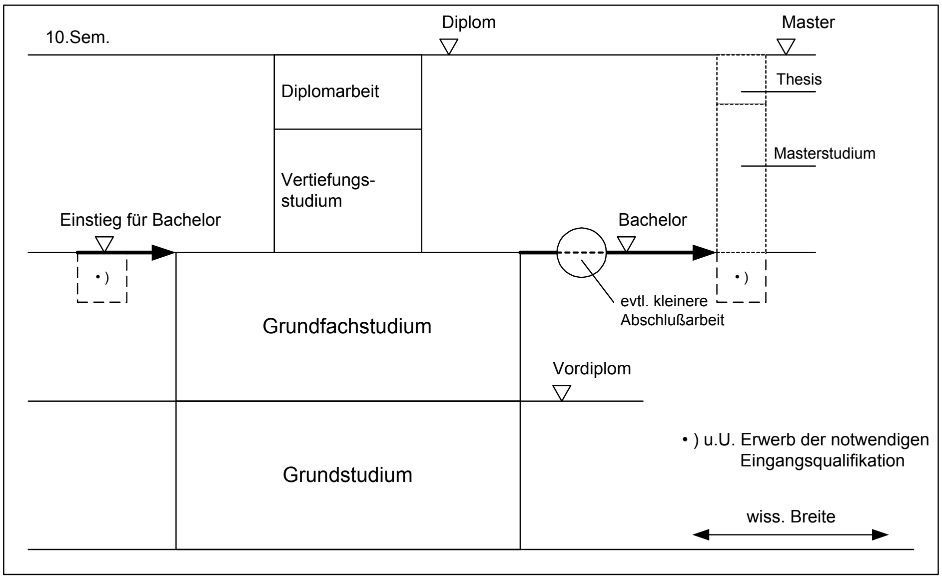


Figure 8

This is a drastic change in comparison with the existing system which provides for two paths in parallel, one leading to the Laurea (five years) and the other leading to the Diploma universitario (three years).

In France, which has one of the most complex and multilayer system of national *diplômes*, some steps have been undertaken as a result of Sorbonne and Bologna process. A new *"professional licence"*, aimed at providing a more effective access to the labour market after theoretically only 3 years, was introduced on a voluntary basis. A new degree, the *Mastaire* was introduced for students who complete 2 years after the *Licence* or graduate from a Grand Ecole. However, these measures have, apparently, no impact on the engineering education in France.

3.3. Two Surveys on trends in European engineering education

Are changes of the kind described in the previous paragraph likely to proliferate?

The author conducted a survey on trends in Higher Engineering Education in Europe in September 1998, among the participants at the SEFI Annual Conference which took place in Helsinki. From the 102 registered participants who attended the Conference, 41 responded to the questionnaire. The survey was repeated in May 2000, among the participants at the Second EUCEET General Assembly which took place in Odense. From the 68 registered participants who attended the General Assembly, 45 responded to the questionnaire.

Here are the questions and the answers received.

First question

Preamble. There are at present two basic systems of higher engineering undergraduate ("pre-licence") education in Europe:

- the *"anglo-saxon system"*, with undergraduate education of 3 years duration, leading to B.S. or B.Eng. degree or of 4 years duration leading to M.Eng. degree;
- the *"continental system",* with undergraduate education with nominal duration of 5 years (exceptionally 4.5 yrs or 6 yrs) leading to a degree which is considered to be equivalent to a Master of Science degree in the anglo-saxon system.

Question 1a: *Do you think that in a foreseeable future (e.g. 10 ... 15 years) the two systems are going to converge to each other, leading to a unified system?*

Choices	SEFI September 1998		EUCEET May 2000	
	No	%	No	%
a. no, absolutely not	14	34	5	11
b. yes	15	37	21	47
c. yes, but not in a foreseeable future	11	27	19	42
d. no opinion	1	2	-	-

Question 1b: *If a convergence would occur, no matter when, what would be, in your opinion, the nominal duration of the unified undergraduate studies in engineering education?*

Choices	SEFI September 1998		EUCEET May 2000	
	No	%	No	%
a. 3-3.5 years	2	5.7	5	11
b. 4 years	9	25.7	5	11
c. 4-4.5 years	5	14.3	4	9
d. 5 years	19	54.3	18	40

Second question

Preamble: In most countries where the *"continental system"* prevails, there are two parallel types of engineering education:

- engineering education of short duration (normally 3-4 years)
- engineering education of long duration (normally 5 years)

Question 2*: Do you consider that in an attempt of harmonization with the anglo-saxon system, the continental system should be restructured in such a way that the two types of education to be put in a "ladder" (like B.S. and M.S.)?*

Choices	SEFI September 2000		EUCEET May 2000	
	No	%	No	%
a. yes, it would be a wise move	9	22	2	5
b. yes, but only after a careful restructuring of existing curricula	13	32	23	51
c. no, contents of the two types of education have different objectives	19	46	19	42
d. no opinion	-	-	1	2

Before making any comments on the results, it is worth to locate in time the two surveys.

The SEFI Conference took place less than 4 months after the Sorbonne meeting where Ministers of Education from France, United Kingdom, Germany and Italy signed in Sorbonne the *"Joint Statement on the Harmonization of the Architecture of the European Systems of Higher Education"*. Although formulated in general terms, the Sorbonne Declaration was a clear signal that the harmonization pursued was encouraging the extension of the "ladder" (anglo-saxon) system.

The EUCEET General Assembly took place almost one year after the meeting where ministers of education from 29 European countries Europe signed the Bologna Declaration on *"The European higher education area"*. Unlike the Sorbonne Declaration, the Bologna Declaration was more specific. Two figures drawn special attention: a minimum duration of three years for the first cycle studies and a term to reach the objectives defined: within the first decade of the third millennium.

Both the size and the structure of the populations involved in the two surveys were almost identical.

Indeed, in both cases 60% of those responding represented countries belonging to the "continental" system. Of course, the population involved in the second survey was homogeneous, representing only one field, civil engineering.

The trends put into evidence by the two surveys are quite interesting. Thus, in September 1998 34% of those who responded considered that the two systems are not going to converge to each other in a foreseeable future, while in May 2000 the percentage reduced to only 11%. This change can be perceived as reflecting the impact on the academic world of the Bologna Declaration.

As for the nominal duration of the unified undergraduate studies, a change also occurred, due probably to the same factor. 68.6% opted for 4.5-5 years in 1998, as compared to 49% in 2000.

Referring to the question 2, the percentage of respondents which considered that the two types of education (of short duration and of long duration) having different contents and different objectives should not be put in a *“ladder”* is almost identical (46% vs 42%). Instead, in the 2000 survey a 19% increase is observed among those who consider that a careful restructuring of existing curricula is a prerequisite for adopting the *“ladder”* system.

One important conclusion derived from the 2000 exercise is that the idea of an unified system is gaining ground. Quite different opinions were expressed concerning the structure of the unified system, although here also the 2000 survey indicates a slight preference for the *“ladder”* system. In any case, the harmonization seems to be, in the opinion of the respondents, a rather lengthy process.

3.4. Possible ways into the future, as seen by Dr. Haug

In the final version – revised after the Bologna meeting and dated 18 August 1999, of the state of the art report [2], Dr. Haug suggested four main avenues for combined action in order to foster the desired convergence and transparency in the structure of qualification in Europe, namely:

- *a generalised European credit system;*
- *a common but flexible frame of reference of qualifications;*
- *an enhanced European dimension in quality assurance and evaluation;*
- *empowering Europeans to use the new learning opportunities in Europe.*

In respect to the first avenue, the report underlines the advantages which could be gained over time by the widespread use of ECTS as a European credit accumulation and transfer system (Here it should be pointed out that in 74 out of the total of 113 schools which responded to the EUCEET WG A questionnaire, there is a credit systems in use, from which in 47 the ECTS).

Of particular interest for this paper is the second avenue: a common but flexible frame of reference for qualifications. Dr. Haug points out:

“A rigid, uniform model (like the 3-5-8 model) is neither desirable nor feasible in the European higher education environment. Existing systems in Europe and elsewhere seem to point instead to an architecture based on 4 steps corresponding to the main entry levels into professional life or to progress steps in studies. The average duration needed to reach these steps are:

about 2, between 3 and 4, about 5, about 8 years,
but the length of studies should be expressed not in years, but as the number of academic credits that need to be successfully completed in order to reach the corresponding level".

In a lecture on Bologna Declaration made at the SEFI Annual Conference in Paris, September 2000, Dr. Haug presented the following *"ideal basic structure"* expressed in terms of ECTS credits (bearing in mind that the workload for one academic year corresponds to 60 ECTS credits):

sub-degree level
60-120 ECTS Certificate
Diploma

first degree level
180 ECTS Bachelor
or 240 ECTS Advanced Bachelor

postgraduate level
less than 60 ECTS postgraduate Certificate/diplom

60-120 ECTS Masters
(not credit-rated) Doctorate/Ph.D

3.5. Positions adopted by the CESAER and SEFI on the Bologna recommendations

When attempts to implement Bologna recommendations at national or institutional level, for a given field of higher education, are made, the one requiring the adoption of a two-tier system stirred most discussions. In fact, as it results from the report [5] presented in Bologna on Saturday 19 June 1999 by Dr. Kenneth Edwards, President of the Association of European Universities (CRE) to the Ministers of Education of 29 European countries, these discussions started on Friday 18 June in Bologna, during the Conference which preceded the Ministers' meeting. One of the conclusions of the Conference was summarized as follows by Dr. Kenneth Edwards:

" ... Considerable discussion of the development of intermediate or first cycle qualifications, for example a Bachelor's Degree after three or four years, took place. It was noted that such a system or architecture was well established in several countries, for example the United Kingdom, and that it had been introduced recently in other countries. These experiments were being observed with great interest throughout European higher education. In general the

participants of the Conference expressed support for the principle but noted some concerns. These included:

- would employers be persuaded to accept such intermediate qualifications as a suitable basis for recruitment?

- would such an arrangement be appropriate for certain professional subjects, for example engineering and medicine, disciplines that usually require an integrated curriculum?"

Although an ardent advocate for the two-tier system, Dr. Haug anticipated, probably, such concerns when he included in the list of positive features of the frame of reference for qualifications he proposed, the following one:

"In a small number of disciplines or at a small number of institutions, longer curricula leading straight to a master degree could be accommodated".

In order to assess the implications of the Bologna process on engineering education, it is important to learn about the position adopted by the two main associations of European engineering schools.

At its 1999 General Assembly, on 29th November 1999 in Helsinki, CESAER adopted an *Opinion on the Sorbonne/Bologna Recommendations* (annex III).

CESAER (Conference of European Schools for Advanced Engineering Education and Research) is an association founded in 1990, grouping leading technical universities from Europe, among which many EUCEET partners: T.U. Vienna, Katholieke Universiteit Leuven, Université Catholique de Louvain, Université Liege, Czech Technical University Prague, Technical University of Denmark Lingby, Helsinki University of Technology, INSA Lyon, TU Berlin, TH Darmstadt, TU Munchen, National Technical University of Athens, Budapest University of Technology and Economics, National University of Ireland, Politecnico di Torino, Politecnico di Milano, TU Delft, Warsaw University of Technology, IST Lisbon, Universidad Politecnica Madrid, Universidad Politecnica de Catalunya, Universidad Politecnica de Valencia, Chalmers University of Technology, Imperial College London, University of Leeds.

The phrase in the CESAER's Opinion which deserves most attention, is the following one:

"As far as engineering education is concerned, CESAER believes that an undergraduate degree should not be a prerequisite for the graduate level".

In other words, CESAER is in favour of curricula leading straight to the master degree, considering that the engineering programme of long duration (normally 5 years) present in most countries of the continent is equivalent with a MS graduate programme in the anglo-saxon system.

Following the round-table with the topic *"Impact of the Bologna Declaration on European Engineering Education"*, which took place at the 28th annual Conference in Paris on 8 September 2000, SEFI General Assembly assigned the Administrative Council to prepare and approve an official statement expressing SEFI's Opinion on the Joint Declaration of the European Ministers of Education signed in Bologna.

SEFI – Société Européenne pour la Formation des Ingenieurs, founded in 1973, is the oldest and largest European association for engineering education.

SEFI's Opinion on Bologna Declaration, approved by the Administrative Council on 2 December 2000, is given in the annex IV.

In essence, SEFI's opinion is not different of the CESAER's one, as far as the 5-year engineering curricula are concerned, as proved by the following statements:

- *the existing European integrated 5-year curricula in engineering are compatible with the idea of a European Education area,*
- *the existing European system of longer integrated curricula leading straight to a Master's degree in Engineering should be maintained, possibly in parallel with a two-tier Bachelor/Master system.*

In addition, SEFI's opinion contains a strong plea in favour of the shorter engineering programmes, seen as distinct programmes, with own aims and content and not as a first part of a two-tier system. The following statement is relevant in this respect:

"Most European countries also have a shorter Engineering Education. The length and character of these curricula may vary slightly from country to country, but they have normally two factors in common: they are more vocationally oriented than the longer programmes and, although bridges normally exist, are not primarily designed as a first part of a two-tier system. Graduates of these programmes play an important role, particularly in small and medium-sized enterprises".

Two conclusions of the *Opinion* are also specifically mentioning the shorter engineering programmes:

- *the longer as well as the shorter, more application oriented, curriculum correspond to a clear need and graduates from both types have a good position on the job market,*
- *the specific qualities of the present, existing, application oriented Engineering degree should be recognised and safe-guarded.*

The explicit call for preserving the European system for engineering education is quite impressive:

"SEFI is convinced that this existing European system for Engineering Education has much merit, that the system is quite compatible with the vision of a European Higher Education Area and that it should not be sacrificed. The cultural diversity of Europe is also a source of richness and changes in the architecture of Engineering Education must not be allowed to destroy this richness".

As for the reform already taking place in some countries, SEFI's Opinion is in favour of acceptance and not rejection.

"... This does not exclude the creation of a two-tier Bachelor/Master system also in Engineering, whenever this is judged appropriate. The goal of such a Bachelor's degree should normally kept distinct from the goal of existing, vocationally oriented, short cycle engineering curricula. The Master's degree should be equivalent to the existing 5-year degrees".

Before closing this chapter on echoes of the Sorbonne/Bologna Declarations, a shift from the opinions of associations/institutions to the ones of individuals concerned might be appropriate.

Here is the opinion of Prof. Giulianno Augusti, from Rome, Chairman of the WG2 of the Thematic Network H3E [6]:

"Let us not forget, in any case, that the profound differences between the European countries with regard to engineer's formation and profession are not occasional, but derive from the fact that Europe is a continent of many cultures. And I do not think that the different cultures should be forced to melt into the pot of an already existing model, but rather that exchanges and increase of mutual knowledge should be facilitated, so as to set the ground for trusting each other more and more and growing together. I strongly maintain that this is the correct way to help the development of a truly united Europe.

Consequently, I am fully persuaded that the national systems cannot (and must not) be "homogenized" from above: on the contrary, diversity and variety are assets of Europe in general, and of the European engineering profession in particular.

Moreover, it is to be expected (and hoped) that throughout Europe higher education will rapidly experience a process of deregulation, and this will also mean an even greater variety of courses and qualifications will be offered".

To remain in Italy, one additional note: while attending the 31st meeting of the ECCE (European Council of Civil Engineers), hosted on 5-6 May 2000 in Rome by the *Consiglio Nazionale degli Ingegneri*, the author learned from the leaders of this organisation, representing the engineering profession in Italy, their opinion that the Reform is not adequate for the engineering education and that "*Consiglio*" is not recognizing the new Laurea after a three-year course as a professional degree.

A similar echo comes from Germany. In the *Resolution* of the Conference of Civil Engineering Faculties [4], mentioned before, is written:

"*There are also serious doubts, at international scale, on the capacity of the Bachelor degree to provide a real qualification for the engineering practice. The American Society of civil Engineers (ASCE) sees the Bachelor degree inadequate as a professional degree for today engineering practice. The same opinion is shared by the German construction industry and by the Conference of Faculties of Civil Engineering*".

4. Trends in American civil engineering education

4.1. A strong call for the Master's degree as the First Professional Degree

On March 19-21, 2000, the Department of Civil and Environmental Engineering of the Massachusetts Institute of Technology organized a very interesting event called *"A New Millennium Colloquium on the Future of Civil and Environmental Engineering"*, at which the author participated. In the opening remarks at the Colloquium, Prof. Rafael Bras, Head of the Department, stressed the need to have the Master of Engineering as the first engineering degree in civil and environmental engineering. In the first keynote address at the Colloquium [7], Prof. G. Wayne Clough, President of the Georgia Institute of Technology, Professor of Geotechnical Engineering, took a similar stand by saying: *"Achieving a curriculum that prepares students for practice in the 21st century will require creative approaches and a willingness to set aside some of what was required in the past. Although the modification of the curriculum will require great effort, the end result can be a more exciting learning experience for both students and faculty, and one that will help attract the talent required to maintain the vitality and adaptability of our profession. The task will become easier if civil engineering designates the master's degree as the first professional degree, which is under serious consideration. If we take this step, it will be important to allow for a generalist's track as well as offering narrow specialities".*

Many other speakers representing the academic world and the industry were also in favour of the move. The strongest endorsement came from dr. Delon Hampton, President of the American Society of Civil Engineers. He reminded the audience that the Board of Direction of ASCE adopted on October 17, 1998 the ASCE Policy Statement 465 (annex V).

Since the change sought for, i.e. to extend from 4 to 5 yrs the duration of studies leading to the first professional degree, is a very important one, it is worth to reproduce here the first two paragraphs of the *Rationale* for the change.

"Increased educational requirements beyond the baccalaureate degree for the practice of civil engineering at the professional level are consistent with other learned professions. The body of knowledge gained, and the skills developed in the formal civil engineering education process, are not significantly less than the comparable knowledge and skills in these other professions. Is it reasonable in such complex and rapidly changing times to think that we can impart the requisite engineering knowledge and skills in four years of formal schooling while other learned professions take seven or eight years? Four years of formal schooling were considered the standard for three professions (medicine, law, engineering) 100 years ago, and while medicine and law education lengthened with the growing demands of their respective professions, engineering education did not. Perhaps this retention of a four-

year undergraduate engineering education has contributed to the lowered esteem of engineering in the eyes of society, and the commensurate decline in compensation of engineers relative to medical doctors and lawyers.

Current baccalaureate programs, while constantly undergoing review and revisions, still retain a nominal four-year education process. This length of time limits the ability of these programs to provide a formal education consistent with the increasing demands of the practice of civil engineering at the professional level. There are diametrically opposed forces trying to squeeze more content into the baccalaureate curriculum while at the same time reducing the credit hours necessary for the baccalaureate degree. The result is a production line baccalaureate civil engineering degree satisfactory for an entry level position, but inadequate for the professional practice of civil engineering. The four year internship period (engineer-in-training) after receipt of the BSCE degree cannot make up for the formal educational material that would be gained from a master's degree program".

The plea contained in the ASCE Policy Statement is, of course, derived from the American realities but parts referring to the present status of the engineering profession, to the challenges faced by the civil engineering education a.s.o., are by no means valid also for Europe. One should then not forget that, still, in many European countries the first engineering degree for professional engineers requires 5 yrs of study.

4.2. Engineering Criteria 2000 for accrediting programs in engineering in the United States

The Accreditation Board for Engineering and Technology (ABET) is recognized in the United States as the sole agency responsible for accreditation of educational programs leading to degrees in engineering. The first statement of the Engineers' Council for Professional Development (ECPD, now ABET) relating to accreditation of engineering educational programs was proposed by the Committee on Engineering Schools and approved by the Council in 1933.
The original statement, with subsequent amendments, was the basis for accreditation until 2000. The statement presented here is required of programs beginning in 2001.

In January 1998, ABET published "Engineering Criteria 2000" [8] for a three-year phased implementation beginning in the 1998-99 accreditation cycle. During the three years (1998-99 through 2000-01), institutions could elect to have their programs evaluated under the existing criteria or under Engineering Criteria 2000".

The ABET accreditation process is a voluntary system of accreditation that

(1) assures that graduates of an accredited program are prepared adequately to enter and continue the practice of engineering

(2) stimulates the improvement of engineering education

(3) encourages new and innovative approaches to engineering education

(4) identifies these programs to the public.

The basic level criteria for accreditation according to "Engineering Criteria 2000" encompass the following eight points:

Criterion 1. Students

Criterion 2. Program Educational Objectives

Criterion 3: Program Outcomes and Assessment

Criterion 4: Professional Component

Criterion 5: Faculty

Criterion 6: Facilities

Criterion 7: Institutional Support and Financial Resources

Criterion 8: Program Criteria

The most significant changes in respect to the criteria used until 2000 occurred in the ways in which are formulated Criteria 3 and 4.

Criterion 3. Program outcomes and assessment, specifies:

Engineering programs must demonstrate that their graduates have

(a) an ability to apply knowledge of mathematics, science, and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(c) an ability to design a system, component, or process to meet desired needs

(d) an ability to function on multi-disciplinary teams

(e) an ability to identify, formulate and solve engineering problems

(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context

(i) a recognition of the need for, and an ability to engage in life-long learning

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Criterion 4: Professional component, specifies subject areas appropriate to engineering but does not prescribe specific courses. The engineering faculty must assure that the program curriculum devotes adequate attention and time to each component, consistent with the objectives of the program and institution. Students must be prepared for engineering practice through the curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier coursework and incorporating engineering standards and realistic constraints that include most of the following considerations: economic; environmental; sustainability; manufacturability; ethical; health and safety; social; and political. The professional component must include

(a) one year of a combination of college level mathematics and basic

sciences (some with experimental experience) appropriate to the discipline

(b) one and one-half years of engineering topics, to include engineering sciences and engineering design appropriate to the student's field of study

(c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.

5. Trans-national recognition and mobility in the engineering profession

The last decades of the 20th century witnessed a professional job market becoming more and more international.

As a result, removing artificial barriers to the free movement and practice of professional engineers and facilitating their cross-border mobility represent issues of paramount importance. However, one cannot speak about trans-national mobility without speaking about recognition.

5.1. Some basic terms: recognition, qualification, accreditation

In this context, *recognition* means *recognition of qualifications*. Important steps were made in Europe toward improving recognition over the past decade, as it results from the following examples.

In a *"Communication on recognition of qualifications for academic and professional purposes"* presented by the European Commission to the Council and the European Parliament in December 1994, [9], were defined four types of *recognition*, namely:

(1) *de jure* professional recognition for access to regulated professions:

(2) *de facto* professional recognition for access to the non-regulated part of the non-regulated parts for the labour market;

(3) cumulative academic recognition;

(4) academic recognition by substitution.

A *"Diplomatic Conference"* convened in Lisbon in April 1997 by the Council of Europe and UNESCO has approved a *"Convention on the Recognition of Qualifications Concerning Higher Education in the European Region"* [10]. The Lisbon Recognition Convention provides an overall, up to date legal framework for the recognition of qualifications in the European Region, replacing a number of previous, by now outdated, conventions.

Recognition is there defined as *"A formal acknowledgement by a competent authority of a foreign educational qualification with a view to access to* *educational and/or employment activities"*. According to the Lisbon Recognition Convention, "*qualification"* can be either a *Qualification giving access to higher education* or a *Higher Education Qualification*, defined as *"Any degree, diploma or other certificate issued by a competent authority attesting the successful completion of a higher education programme"*.

The *Diploma Supplement*, developed jointly by the European Commission, the Council of Europe and UNESCO, is specifically mentioned in the Bologna Declaration in the context of the *"adoption of a system of easily readable and comparable degrees"*. The *Diploma Supplement* provides a format for describing individual qualifications in a way making it easier for foreign credential evaluators and admissions officers to assess them and helps situating a qualification within the education system to which it belongs.

In relation with the recognition process should be mentioned also the *ECTS (European Credit Transfer System)*, developed by the European Commission, to which reference is also made in the Bologna Declaration. ECTS facilitates the transfer of credits obtained during periods of study abroad to the home institution or another institution. In fact, the recognition of the study period abroad by the sending institution became a prerequisite for the student mobilities under the frame of the SOCRATES-Erasmus programme.

The mentioned examples show that *recognition and qualification* are present and defined in a number of official documents issued by European bodies in recent years. This is not the case with the term of *accreditation* which is not used in the same documents. The *"Lisbon Recognition Convention* speaks about *"assessment"* either of *institutions or programmes*, or of *individual qualifications*. The term *accreditation* owes its use because it figures in the name of the oldest agency of the kind in the field of engineering education, founded in the 1930 in the US: the *Accreditation Board for Engineering and Technology (ABET)*, which defines *accreditation process* as a system which *"assures that graduated of an accredited programme are prepared adequately to enter and continue the practice of engineering"*.

Referring to this matter, Prof. Augusti [6] writes:

"By definition, the accreditation process always "belongs" entirely to the accrediting body (for instance, the accrediting body is the Engineering Council in the UK, the ABET in the US). The criteria of assessment may be set entirely by the accrediting body (and accepted by the parties concerned) or by a National Law or a European Directive (e.q. the Architects' Directive). Accreditation should always be connected with a process of quality assessment and quality assurance, albeit in practice this may sometimes be merely formal.

Finally, the holder of an "accredited degree", possibly after fulfilling some further non-academic requirements, is entitled to what I define "professional qualification", i.e. the right of actually practicing his/her profession: usually, this is shown by the acceptance of the engineer in a "Guild" (Order, *Association, etc): thus, "professional qualification" (of an individual) is distinct from "accreditation" (of an educational programme). Let us remember that "professional qualification" is not (and must not be) concerned with "equivalence of degrees", but rather with "equivalence of professional qualifications": therefore its requirements cannot be related only to academic education, although they cannot ignore it, because it does form the basis of the engineer's culture".*

5.2. Review of academic and professional qualifications throughout Europe

Presently, there is no truly European system of recognition and accreditation of engineering degrees and professional qualifications of engineers.

In the table 3 are summarized basic informations concerning academic and professional qualifications throughout Europe, with respect to the civil engineering profession, as compiled in a comprehensive ECCE Report [11].

The table, like the answers obtained for the Questionnaire launched by the EUCEET Working Group A, shows the wide variety of engineering titles and designations.

The academic qualifications is protected by law in most countries, including those in which engineering titles and the profession are not regulated. The right to award engineering degrees is limited to specific educational institutions in which case the recognition is practically automatic within the country concerned.

As results from the table 3, the engineering profession is regulated by law in three European countries: Italy, Greece and Portugal. Italy and Greece require not only an accredited degree, but also a formal examination before admittance to the Professional Association, while Portugal requires the examination only from graduates holding a non-accredited degree.

With few exceptions, accreditation agencies of a kind or another exist in all European countries represented in ECCE. When compulsory or voluntary rules to which each degree course should conform are set up by a National Authority, accreditation (*de jure* or *de facto*) is practically automatic. In some countries, like Romania, degrees courses are accredited through an "*a posteriori*" evaluation process.

Registration of engineering professionals is required in most countries. A particular situation is in the UK where, although the engineering profession is free, only membership of a chartered professional institution (like Institution of Civil Engineers or Institution of Structural Engineers) give the right to the title of Chartered Engineer, as a professional qualification, title which, as was shown at p. 3.2, requires a period of acceptable engineering experience after graduating with an accredited degree.

A trans-national system for professional qualifications has been set up since 1989 by FEANI (Fédération Européenne d'Associations Nationales d'Ingénieurs – European Federation of National Engineering Associations). FEANI introduced the title of "European Ingenieur" (EUR ING) and established Standards for Registration.

The minimum educational requirement is at least a 3-year engineering course at university level, with the entrance condition of a high level full secondary education up to the age of 18 years.

Table 3

Country	Higher academic qualifications	Protection by law of the academic qualification	Engineering profession regulated by law	Accreditation of engineering programmes	Registration of engineering professionals
Belgium	Ingenieur technician – 3 yrs Ingenieur industrial – 4 yrs Ingenieur civil – 5 yrs	No		Yes	No
Czech Republic	Master of Science – 5 yrs Bachelor of Science – 3 yrs	Yes			Yes
Denmark	BSc-Diplom ingenieur - 3.5 yrs MSc – civil ingenieur – 5 yrs	Yes		Yes	Yes
Estonia	BSc or BEng – 4 yrs MSc or MEng + 2 yrs				
Finland	MSc CE – 5 yrs BSc CE – 4 yrs Technician – 4 yrs	Yes		Yes	
France	Prep+Grand Ecole – 5 yrs Univ – Ingen. Diplome – 5 yrs	No		Yes	Yes Repertoire Francais des Ingenieurs
Germany	Dipl-Ing FH – 4 yrs Dipl-Ing TU, TH – 5 yrs	Yes		Being introduced	Yes
Greece	Diplome Engineer – 5 yrs	Yes	Yes	Yes	Yes
Ireland	Univ.Degree in eng. – 4 yrs National Diplome – 3 yrs National Certificate – 2 yrs	No		Yes	Yes
Italy	Diploma – 3 yrs Laurea – 5 yrs	Yes	Yes	proposal	Yes Colegio de Ing. (Albo)
Portugal	Licenciatura – civ.eng. – 5 yrs Bacharelato–civ.techn.eng –3 yrs	Yes	Yes	Yes	Yes Ordem dos Eng.
Romania	Engineer – 5 yrs Subengineer – 3 yrs	No		Yes	No
Slovenia	Degree in Civ. Eng. – 4 yrs Professional higher educ. degree in civ. eng.–3 yrs	Yes		Yes	
Spain	Ingeniero Superior de Caminos, Canales y Puertos – 5-6 yrs Ingeniero Tecnico de Obras Publicas – 3 yrs	Yes		Yes	Yes Colegio des Ing.
UK	MEng – 4 yrs BEng – 3 yrs National Dipl. or Certificate – 2 yrs	No		Yes	Yes ICE, ISE

The minimum professional requirement is at least 2 years of engineering experience. The registration can be obtained when the individual proves that the totality of education and subsequent approved professional experience is of 7 years and it gives the registrant the right to be called "European Ingenieur" (EUR ING).

In order to maintain the admission to the Register, FEANI has set up a List of School and Courses – the FEANI INDEX, listing all programs of engineering education from FEANI member countries which meet the FEANI minimum requirement and which have curricula enabling the graduates to develop towards professional experience expected by FEANI.

The number of universities for each FEANI country listed in the FEANI INDEX is given in the table 4 [12]. About 780 universities and engineering schools are at present accredited by FEANI.

Table 4

FEANI Country	Number of Universities	FEANI Country	Number of Universities	FEANI Country	Number of Universities
AT Austria	6	FI Finland	32	MT Malta	1
BE Belgium	34	FR France	200	NL Netherlands	36
CH Switzerland	29	GB United Kingdom	93	NO Norway	21
CY Cyprus	-	GR Greece	6	PL Poland	30
CZ Czech Republic	8	HU Hungary	16	PT Portugal	26
DE Germany	119	IE Ireland	9	RO Romania	10
DK Denmark	14	IS Iceland	2	SE Sweden	12
EE Estonia	1	IT Italy	33	SI Slovenia	2
ES Spain	32	LU Luxembourg	1	SK Slovakia	4

As could be understood from this succinct presentation, no distinction is made, in the FEANI Standards, between "long-cycle" and "short-cycle" graduates.

Since the creation of EUR ING Register in 1989, FEANI has awarded more than 25000 EUR ING certificates to applicants from all member countries, more than 2000 awards per year.

5.3. The "European Standing Observatory for the Engineering Profession and Education" (ESOEPE)

The Working Group 2 of the SOCRATES Thematic Network project H3E (Higher Engineering Education for Europe) which functioned between 1 September 1996 and 31 August 1999, was assigned the themes of quality and recognition. In cooperation with the Association of Dutch Universities, the WG 2 organised in December 1998 in the Hague the "*First European Workshop on Accreditation of Engineering Programmes*" which gave the opportunity of a broad exchange of information and of points of view between numerous responsible authorities of all Europe, concerning the present procedures for recognition and accreditation. Six months later, in June 1999, the WG 2 together with the "*Commission des Titles d'Ingénieur*" of France, organised in Paris the "*Second European Workshop on Assessment of Engineering Programmes*".

The main conclusion derived from the two workshops was that a "*European Board for Engineering and Technology*", following the ABET model, was neither feasible nor desirable. Instead, a common ground was found for creating a *permanent observatory,* a network of national agencies and other bodies representing both the academic and professional communities, interested in matters of evaluation and accreditation. And thus, in September 2000, an Agreement was concluded in Paris, to set up, for a tentative period of three years, the "*European Standing Observatory for the Engineering Profession and Education*". The agreement is reproduced in the annex VI.

The ESOEPE Steering Committee convened for 26 January 2001 in Darmstadt EWAEP-3 "*Third European Workshop on Assessment and Accreditation of Engineering Programmes*" together with the first Public Meeting of the ESOEPE.

5.4. Steps towards enhancing the trans-national mobility of engineers

A distinct feature of the world economy of the late 20th century has been the globalization of industries and services. The globalization increased the need for international practice of engineers without regard to national boundaries.

A number of initiatives have been taken in the last decade in order to facilitate the cross-border mobility of professional engineers.

In first place has to be mentioned the "*Washington Accord*" on "*Recognition of equivalency of accredited engineering education programs leading to the engineering degree*" which by 1995 was signed by Australia, Canada, the United States, Ireland, New Zealand, United Kingdom, South Africa and Hong Kong. The signatories have exchanged information on, and have examined, their respective processes, policies and procedures for granting accreditation to engineering academic programs, and have concluded that these are comparable. Through the Washington Accord, the signatories recognized the substantial equivalence of such programs in satisfying the academic requirements for the practice of engineering at the professional level.

A step further was the agreement reached in October 1997 by the signatories of the *Washington Accord* to establish a forum, to be known as the *Engineers Mobility Forum (EMF)*, through which they, as the representatives of the relevant engineering organizations in their respective countries or territories, would:

- develop, monitor, maintain and promote mutually acceptable standards and criteria for facilitating the cross-border mobility of experienced professional engineers;
- seek to gain a greater understanding of the existing barriers to mobility and to develop and promote strategies to help governments and licensing authorities manage those barriers in an effective and non-discriminatory

manner;

- encourage the relevant governments and licensing authorities to adopt and implement mutual mobility procedures consistent with the standards and practices recommended by the signatories to such agreements as may be established by and through the EMF;
- identify, and encourage the implementation of best practice for the preparation and assessment of engineers intending to practice at the professional level; and
- continue mutual monitoring and information exchange by whatever means are considered most appropriate.

The founding members of the Engineers Mobility Forum are: the Canadian Council of Professional Engineers; the Engineering Council of South Africa; the Engineering Council, United Kingdom; the Hong Kong Institution of Engineers; the Institution of Engineers, Australia; the Institution of Engineers of Ireland; the Institution of Professional Engineers, New Zealand; the United States Council for International Engineering Practice.

Other organizations wishing to contribute to the work of the EMF, and prepared to subject their procedures and criteria to examination by the Members, could be admitted as provisional members. The following organizations would initially be provisional members: the Federation of European National Engineering Associations (FEANI); the Japan Consulting Engineers Association.

An initiative similar to EMF has been promoted in 1999 by the *APEC Engineer Coordinating Committee*, representing engineering organizations from the Asia-Pacific Economic Community, namely to establish a Register of APEC Engineers.

5.5. ECCE and the Register of European Civil Engineers

ECCE (European Council of Civil Engineers) was created in 1985 through the common belief among European civil engineers that they are better placed to advance Europe’s built environment and protect its natural environment by working together. The EU institutions now recognise ECCE as the single voice for the profession. ECCE members are the professional Civil Engineering associations in individual European countries. The current membership is made up of members from Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Poland, Portugal, Romania, Russia, Slovenia, Spain, Turkey and United Kingdom.

ECCE discussed the broad principles of a framework which might enable progress towards removing artificial barriers to the free movement and practice of professional engineers amongst member countries at its meetings in Bucharest and Munich in 1998, at Dublin and Nicosia in 1999, at Rome in 2000 and at two special meetings in Frankfurt on February 1999 and March 2000.

As a result of these discussions, at its meeting in London, in October 2000, ECCE decided to create and maintain a Register of European Civil Engineers.

ECCE will use its best efforts to ensure that persons are entered on the Register only when they have:

• *demonstrated, to the satisfaction of all signatories, a level of academic achievement at least equal to that of a graduate holding an engineering degree accredited by an organization holding full membership of, and acting in accordance with the terms of, the Washington Accord or 4 years in an institution of higher education and a system of Quality Assurance approved by ECCE.*

• *having completed a period of training and experience, building on the academic phase, which will provide the graduate with the competence to analyse, solve and implement complex civil engineering problems. This will be normally 3/4 years duration.*

• *been assessed by a competence assessment by the signatory organization, in accordance with agreed guidelines.*

• *maintained their continuing professional development at a satisfactory level, in accordance with agreed guidelines.*

The implementation of the proposal is a two step process:

• *Stage 1 is agreement on the requirements of a Register of European Civil Engineers who posses the education, level of experience and competence set out above. Technically the Register will be held in a de-centralised form in order to minimise additional costs;*

• *Stage 2 is a statement of intent by all parties to recognise engineers on this register favourably in gaining access to practice in the member countries.*

To ensure consistency in application of the agreed criteria, ultimate authority for entering persons in the Register of European Civil Engineers will remain with a Steering Committee, comprising a Chairman appointed by a General Meeting of ECCE members and elected representative from each ECCE member who signed up. The primary objective of the Steering Committee will be to facilitate the compilation and operation of an authoritative decentralised Register of European Civil Engineers.

Each ECCE member organisation signing up to this system will undertake to develop and maintain a section of the Register in their country open to professional engineers whose qualifications and technical and professional expertise have been assessed as in compliance.

Each ECCE national member organisation will be responsible for certifying the qualifications and experience of individual professional engineers seeking entry to the register, whether or not the assessment of such candidates is delegated to an associated body. ECCE members will be obliged to recognise the equivalent qualifications of other organisations who have signed up to the ECCE process.

ECCE member organisations in one country will do their utmost to ensure that other individual members will be fully recognised in that country.

The process of establishing a register will commence when at least four ECCE members have become signatories to the Agreement.

The Steering Committee will continue to function as long as four ECCE members wish to operate their section of the Register.

At the 32nd ECCE meeting held in London, on 27th-28th October 2000, the representatives of civil engineers associations from five member countries (United Kingdom, Czech Republic, Greece, Romania and Russia) indicated the intention to sign up the Agreement. Therefore, it is expected that the Register will be established in 2001.

6. Concluding remarks

European engineering education, like other fields of higher education, is facing major challenges at the turn of the century and of the millennium. There is a need for greater compatibility and comparability in the systems of engineering education, which should become more attractive to students from other world regions. There is a need to eliminate remaining obstacles to the free mobility of students, teachers and graduates. There is a need for quality assurance without boundaries and for comparative evaluation of curricula and learning.

The Thematic Network EUCEET was built in the right time to help European civil engineering schools to better define their mission and to bring answers to the challenges of the kind mentioned before.

Considering the outcomes of the activity of the three Working Groups which functioned in 1999 and 2000 and the objectives of the three new Working Groups which commenced their activity in May 2000, it becomes clear that EUCEET, as a European-wide discipline-based network, has a very important role to play for the development of civil engineering education in Europe.

The Survey on curricula for undergraduate education in civil engineering undertaken by the WG A led to the collection of very valuable information on organisation of study in civil engineering across Europe. Analysis of existing curricula put into evidence features and trends for various types of programmes, becoming thus an useful instrument for comparison and benchmarking.

The outcomes of the WG B brought significant contributions of EUCEET to the crucial problems of quality assessment and accreditation. A survey on quality management in civil engineering educational institutions helped to identify a large variety of ways to manage, assess and maintain quality in civil engineering education.

Synergies between university-research-industry-public authorities in the construction sector of Europe were emphasised in the Report prepared by the

WG C, based on a comprehensive Survey. It was shown that the constant dialogue and the continuous cooperation between the higher education institutions and other partners represent a source of strength and a key factor in defining new areas of development for the university.

Engineering education in Europe or elsewhere started with civil engineering. Many other subjects appeared meantime, some of them of great attractiveness for the young people. But civil engineering remains in each country a strong pillar not only for the engineering education but for the higher education as a whole. And, as clearly proved by EUCEET, civil engineering is an important part of the European area of higher education.

References

[1] Ruffio, Philippe "Changing the University: the supporting role of the Erasmus Thematic Networks (a three-year perspective) Report to the European Commission, DG Education and Culture, January 2000"

[2] Haug, Guy "Trends and Issues in Learning Structures in Higher Education in Europe" Beiträge Zur Hochschulpolitik 1/2000, Hochschul Rektoren Konferenz, Bonn, Februar 2000

[3] SARTOR Standards and Routes to Registration, 3rd edition, 1997, Engineering Council, 10 Maltravers St, London

[4] Raum, W: "Zur Internationalisierung des Studiums – Über die Bedeutung von Bachelor – und Master – Abschlüssen in Bauingenieurwesen", Bauingenieur, Baud 75, Mai 2000

[5] Edwards, J.R. Kenneth "Report to the Ministers of Education of 29 European countries", Bologna, 18 June 1999, in Beiträge Zur Hochschulpolitik 1/2000, Hochschul Rektoren Konferenz, Bonn, Februar 2000

[6] Augusti, Giuliano "European Engineering Formation: The Problem of Trans-national Recognition", European Journal of Engineering Education, vol. 24, No. 1, 1999

[7] Clough, W.G. "Civil Engineering in the Next Millennium", CEE New Millennium Colloquium, March 20-21, 2000, Cambridge http://web.mit.edu/civen/www/colloquium.html

[8] "Engineering Criteria 2000", 2nd edition. Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, Baltimore, 1998

[9] "Communication on recognition of qualification for academic and professional purposes", European Commission, December 1994

[10] "Convention on the Recognition of Qualifications Concerning Higher Education in the European Region", Council of Europe, Lisbon, April 1997

[11] "The Civil Engineering Profession in Europe – an overview of

professional activity throughout Europe", issued: Summer 1998, The European Council of Civil Engineers, 1 Great George Street, London
[12] Hernaut, Krone "International Mobility of Professional Engineers – Role of FEANI", FEANI unpublished report

Annex I

THE SORBONNE DECLARATION
Paris, May 25, 1998

JOINT DECLARATION ON HARMONISATION OF THE ARCHITECTURE OF THE EUROPEAN HIGHER EDUCATION SYSTEM

The European process has very recently moved some extremely important steps ahead. Relevant as they are, they should not make one forget that Europe is not only that of the Euro, of the banks and the economy: it must be a Europe of knowledge as well. We must strengthen and build upon the intellectual, cultural, social and technical dimensions of our continent. These have to a large extent been shaped by its universities, which continue to play a pivotal role for their development.

Universities were born in Europe, some three quarters of a millenium ago. Our four countries boast some of the oldest, which are celebrating important anniversaries around now, as the University of Paris is doing today. In those times, students and academics would freely circulate and rapidly disseminate knowledge throughout the continent. Nowadays, too many of our students still graduate without having had the benefit of a study period outside of national boundaries.

We are heading for a period of major change in education and working conditions, to a diversification of courses of professional careers, with education and training throughout life becoming a clear obligation. We owe our students, and our society at large, a higher education system in which they are given the best opportunities to seek and find their own area of excellence.

An open European area for higher learning carries a wealth of positive perspectives, of course respecting our diversities, but requires on the other hand continuous efforts to remove barriers and to develop a framework for teaching and learning, which would enhance mobility and an ever closer cooperation.

The international recognition and attractive potential of our systems are directly related to their external and internal readabilities. A system, in which two main cycles, undergraduate and graduate, should be recognized for international comparison and equivalence, seems to emerge.

Much of the originality and flexibility in this system will be achieved through the use of credits (such as in the ECTS scheme) and semesters. This will allow for validation of these acquired credits for those who choose initial or continued education in different European universities and wish to be able to acquire degrees in due time throughout life. Indeed, students should be able to enter the academic world at any time in their professional life and from diverse backgrounds.

Undergraduates should have access to a diversity of programmes, including opportunities for multidisciplinary studies, development of a proficiency in languages and the ability to use new information technologies.

In the graduate cycle, there would be a choice between a shorter master's degree and a longer doctor's degree, with possibilities to transfer from one to the other. In both graduate degrees, appropriate emphasis would be placed on research and autonomous work.

At both undergraduate and graduate level, students would be encouraged to spend at least one semester in universities outside their own country. At the same time, more teaching and research staff should be working in European countries other than their own. The fast growing support of the European Union for the mobility of students and teachers should be employed to the full.

Most countries, not only within Europe, have become fully conscious of the need to foster such evolution. The conferences of European rectors, University presidents, and groups of experts and academics in our respective countries have engaged in widespread thinking along these lines.

A convention, recognising higher education qualifications in the academic field within Europe, was agreed on last year in Lisbon. The convention set a number of basic requirements and acknowledged that individual countries could engage in an even more constructive scheme. Standing by these conclusions, one can build on them and go further. There is already much common ground for the mutual recognition of higher education degrees for professional purposes through the respective directives of the European Union.

Our governments, nevertheless, continue to have a significant role to play to these ends, by encouraging ways in which acquired knowledge can be validated and respective degrees can be better recognised. We expect this to promote further inter-university agreements. Progressive harmonisation of the overall framework of our degrees and cycles can be achieved through strengthening of already existing experience, joint diplomas, pilot initiatives, and dialogue with all concerned.

We hereby commit ourselves to encouraging a common frame of reference, aimed at improving external recognition and facilitating student mobility as well as employability. The anniversary of the University of Paris, today here in the Sorbonne, offers us a solemn opportunity to engage in the endeavour to create a European area of higher education, where national identities and common interests can interact and strengthen each other for the benefit of Europe, of its students, and more generally of its citizens .We call on other Member States of the Union and other European countries to join us in this objective and on all European Universities to consolidate Europe's standing in the world through continuously improved and updated education for its citizens.

Signed by the Ministers of Education of:
France, Italy, United Kingdom and Germany

Annex II

The Bologna Declaration	The European higher education area
Joint declaration of the European Ministers of Education	

Bologna, June 19, 1999

The European process, thanks to the extraordinary achievements of the last few years, has become an increasingly concrete and relevant reality for the Union and its citizens. Enlargement prospects together with deepening relations with other European countries provide even wider dimensions to that reality. Meanwhile, we are witnessing a growing awareness in large parts of the political and academic world and in public opinion of the need to establish a more complete and far - reaching Europe, in particular building upon and strengthening its intellectual, cultural, cultural, social and scientific and technological dimensions.

A Europe of Knowledge is now widely recognised as an irreplaceable factor for social and human growth and as an indispensable component to consolidate end enrich the European citizenship, capable of giving its citizens the necessary competencies to face the challenges of the new millennium, together with an awareness of shared values and belonging to a common social and cultural space.

The importance of education and educational co-operation in the development and strengthening of stable, peaceful and democratic societies is universally acknowledged as paramount, the more so in view of the situation in South East Europe.

The Sorbonne declaration of 25th of May 1998, which was underpinned by these considerations, stressed the Universities' central role in developing European cultural dimensions. It emphasised the creation of the European area of higher education as a key way to promote citizens' mobility and employability and the Continent's overall development.

Several European countries have accepted the invitation to commit themselves to achieving the objectives set out in the declaration, by signing it or expressing their agreement in principle. The direction taken by several higher education reforms launched in the meantime in Europe has proved many Goverments' determination to act.

European higher education institutions, for their part, have accepted the challenge and taken up a main role in constructing the European area of higher education, also in the wake of the fundamental principles laid down in the Bologna Magna Charta Universitatum 1988. This is the highest importance, given that Universities' independence and autonomy ensure that higher education and research systems continuously adapt to changing needs, society's demands and advances in scientific knowledge.

The course has been set in the right direction and with meaningful purpose. The achievement of greater compatibility and comparability of the systems of higher education nevertheless requires continual momentum in order to be fully accomplished. We need to support it through promoting concrete measures to achieve tangible forward steps. The 18th June meeting saw participation by authoritative experts and scholars from all our countries and provides us with very useful suggestions on the initiatives to be taken.

We must in particular look at the objective of increasing the international competitiveness of the European system of higher education. The vitality and efficiency of any civilisation can be measured by the appeal that its culture has for other countries. We need to ensure that the European higher education system acquires a worldwide degree of attraction equal to our extraordinary cultural and scientific traditions.

While affirming our support to the general principles laid down in the Sorbonne declaration, we engage in co-ordinating our policies to reach in the short term, and in any case within the first decade of the third millennium, the following objectives, which we consider to be of primary relevance in order to establish the European area of higher education and to promote the European system of higher education and to promote the European system of higher education world-wide:

- Adoption of a system of easily readable and comparable degrees, also through the implementation of the Diploma Supplement, in order to promote European citizens' employability and the international competitiveness of the European higher education system.
- Adoption of a system essentially based on two main cycles, undergraduate and graduate. Access to the second cycle shall require successful completion of first cycle studies, lasting a minimum of three years, The degree awarded after the first cycle shall also be relevant to the European labour market as an appropriate level of qualification. The second cycle should lead to the master and/or doctorate degree as in many European countries.
- Establishment of a system of credits -such as in the ECTS system- as a proper means of promoting the most widespread student mobility. Credits could also be acquired in non-higher education contexts, including lifelong learning, provided they are recognised by receiving Universities concerned.
- Promotion of mobility by overcoming obstacles to the effective exercise of free movement with particular attention to:
  - for students, access to study and training opportunities and to related services
  - for teachers, researchers and administrative staff, recognition and valorisation of periods spent in a European contest researching, teaching and training, without prejudicing their statutory rights.

• Promotion of European co-operation in quality assurance with a view to develop comparable criteria and methodologies.

• Promotion of the necessary European dimensions in higher education, particularly with regards to curricular development, inter-institutional co-operation, mobility schemes and integrated programmes of study, training and research.

We hereby undertake to attain these objectives -within the framework of our institutional competencies and taking full respect of the diversity of cultures, languages, national education systems and of University autonomy- to consolidate the European area of higher education. To that end, we will pursue the ways of intergovernmental co-operation, together with those of non-governmental European organisations with competence of higher education. We expect Universities to again respond promptly and positively and to contribute actively to the success of our endeavour.

Convinced that the establishment of the European area of higher education requires constant support, supervision and adaptation to the continuously evolving need, we decide to meet again within two years in order to assess the progress achieved and the new steps to be taken.

Signed by the Ministers of Education of:

Austria, Belgium (French community), Belgium (Flemish community), Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, The Netherlands, Norway, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, Swiss Confederation, United Kingdom.

Annex III

Conference of European Schools for Advanced Engineering Education and Research

CESAER

CESAER Opinion on the Sorbonne / Bologna Recommendations

CESAER supports the basic idea of creating a European educational space, encouraging exchanges and mobility, while maintaining the cultural diversity of the national educational systems.

In this context, CESAER emphasises the importance of research in advanced engineering education. More detailed comments are the following:

1. CESAER is in favour of the full implementation of the ECTS as a tool for better transparency in all engineering institutions and particularly within its own membership.

CESAER wishes to improve the system in order to allow for more flexibility in its application.

2. CESAER recognizes the value of defining undergraduate and graduate levels in academic studies. As far as engineering education is concerned, CESAER believes that an undergraduate degree should not be a prerequisite for the graduate level.

3. Engineering schools should provide the possibility for students coming from other continents with an undergraduate degree to enter the graduate programme at European engineering universities.

4. CESAER thinks that the introduction of a semester system at all European universities is an ambitious goal that might never be achieved. To enhance mobility, an important step would be the compatibility of all academic calendars across Europe.

5. When defining levels, the specific needs of engineering education should carefully be taken into account. Engineers work in a wide variety of areas and there is a diversity of engineering education cultures across Europe. Recognizing that this is a wealth worth maintaining, CESAER wishes to promote an outcome-based definition of the quality of study programmes, combined with the application of a common language by which this outcome is described and a common methodology by which the quality of these programmes is validated.

Approved by the General Assembly in Helsinki, November 27th 1999

Annex IV

European Society for Engineering Education
Europäische Gesellschaft für Ingenieur-Ausbildung
Société Européenne pour la Formation des Ingénieurs

SEFI's Opinion on the Joint Declaration of the European Ministers of Education, signed in Bologna.
Brussels, 4th December 2000

SEFI welcomes the important initiative taken by the European ministers of Education in signing the Joint Declaration in Bologna in June last year. SEFI strongly supports the idea of the creation of a European Higher Education Area.

SEFI wishes to make the following general comments:

- *SEFI shares the opinion of the Ministers concerning the need for a system of easily readable and comparable degrees, through a Diploma Supplement or otherwise,*
- *SEFI supports a wider use of the ECTS system as a proper means to promote student mobility*
- *SEFI is convinced of the importance of increased mobility for students, teachers, researchers and administrative staff and it does in many ways promote such mobility,*
- *SEFI is already, by its statutes, committed to the idea of developing the European dimension in Education. It does so primarily by serving as a network of engineering educators and a forum for discussion and information exchange, as well as through the activities of its Working Groups, for instance, in curriculum development,*
- *SEFI shares the opinion of the European Ministers concerning the importance of European cooperation in quality assurance and accreditation. In certain countries in Europe, Engineering Education programmes are already accredited by competent bodies. SEFI welcomes any initiative leading to a common reflection, aiming at a deeper understanding and cooperation between these agencies. SEFI is fully prepared to pursue its action in this area, in cooperation with these accreditation agencies and other organisations.*

The Ministers also commit themselves to the adoption of an education system based on two main cycles, where the first cycle shall in itself be relevant to the labour market and where the second should lead to a Master's degree.

The introduction of a larger number of Master's degree programmes, building on Bachelor's degrees, will no doubt make European Engineering Education more attractive for non-European students, especially if the programmes are run entirely or partly in English. It will also facilitate student mobility within Europe. SEFI therefore welcomes a large-scale introduction of separate 1-2 year Master's Programmes in Engineering.

The particular conditions and circumstances of Engineering Education must, however, be taken into consideration. It is often said that the educational systems across Europe are very different. This may be true in some fields but in Engineering Education the systems are already similar in many respects. There are many reasons behind this. One reason is the international character of the engineering profession. Another is the influence that the classical 19th century German technical university has had in the past as a model for other countries, particularly in Northern, Eastern and Central Europe. SEFI and other organisations have also contributed to a convergence of ideas.

In many European countries, two distinct types of engineering curricula are offered, one more scientifically oriented and one more application-oriented. Both of these have been developed to respond to the particular needs of industry and graduates of both types of curricula are well received by the job market.

There is today a high degree of consensus that the professional engineering degree should take about five years following secondary school. An exception has always been the United Kingdom, which has traditionally accepted the three-year honours degree as an adequate university education for the professional engineer, but its system of separate professional recognition adds further years of practical training to the qualification requirements. Recently, Britain has moved in the direction of its European partners by making the four-year MEng degree the minimum academic requirement for professional recognition as a Chartered Engineer.

Most European countries also have various forms of shorter Engineering Education. The length and character of these curricula may vary slightly from country to country but they have normally two factors in common; they are more vocationally oriented, or application-oriented, than the longer programmes and, although bridges normally exist, they are not primarily designed as a first part of a two-tier system. Graduates of these programmes play an important role, particularly in small and medium-sized enterprises.

SEFI is convinced that this existing European system for Engineering Education has much merit, that the system is quite compatible with the vision of a European Higher Education Area and that it should not be sacrificed. The cultural diversity of Europe is also a source of richness and changes in the *architecture of Engineering Education must not be allowed to destroy this richness.*

This does not, of course, exclude the creation of a two-tier Bachelor/Master system also in Engineering Education, whenever this is judged appropriate. The Master's degree should, in such cases, be equivalent to the existing 5-year degrees.

It is also essential that changes in the organisation of engineering studies take into account the ongoing evolution in the transfer of knowledge and the emergence of virtual universities, flexible learning and distance education.

SEFI's view is thus that:

- *any reform of the structure of European Engineering Education must take the particular conditions of this field of education into account,*
- *the existing European integrated 5-year curricula in Engineering are compatible with the idea of a European Education area,*
- *the existing European system of longer integrated curricula leading straight to a Master's Degree in Engineering should be maintained, possibly in parallel with a two-tier Bachelor/Master system,*
- *the longer, as well as the shorter, more application-oriented, curricula, correspond to a clear need and graduates from both types of programme have a good position on the job market,*
- *the specific qualities of the present, existing, application-oriented Engineering degrees should be recognised and safe-guarded,*
- *the creation of new 1-2 year Master's programmes in Engineering should be encouraged.*

Annex V

ASCE Policy Statement 465

FIRST PROFESSIONAL DEGREE

Approved by the Educational Activities Committee on September 9,1998
Approved by the Committee on Policy Review on October 2,1998
Adopted by the Board of Direction on October 17,1998

Policy

The American Society of Civil Engineers (ASCE) supports the concept of the Master's degree as the First Professional Degree for the practice of civil engineering at a professional level. ASCE encourages institutions of higher education, governmental units, employers of civil engineers, and other appropriate organizations to endorse, support, and promote the concept of mandatory post-baccalaureate education for the practice of civil engineering at a professional level. The implementation of this effort should occur through establishing appropriate curricula in the formal education experience, appropriate recognition and compensation in the workplace, and congruent standards for licensure.

Issue

The civil engineering profession is undergoing significant, rapid, and revolutionary changes making the baccalaureate civil engineering degree an entry level degree that is inadequate preparation for the practice of civil engineering at the professional level. These changes include the following:
- Globalization has challenged the world-wide geographic boundaries normally recognized in the past, primarily as a result of enhanced communication systems.
- Information technology has made, and continues to make, more information available; however, the analysis and application of this information is becoming more challenging.
The diversity of society is challenging our traditional views and people skills.
-New technologies in engineering and construction are emerging at an accelerating rate.
- Enhanced public awareness of technical issues is creating more informed inquiry by the public of the technical, environmental, societal, political, legal, aesthetic, and financial implications of engineering projects.
- Civil infrastructure Systems within the United States are rapidly changing from decades of development and operation to the renewal, maintenance, and improvement of these systems.
These changes have created a market requiring civil engineers to have simultaneously greater breadth of capability and specialized technical

competence than that required of previous generations. For example, many civil engineers must increasingly assume a different primary role from that of designer to that of team leader. This changing market and role for the civil engineer can be addressed by appropriate, formal post-baccalaureate education among other fundamental requirements.

Rationale

Increased educational requirements beyond the baccalaureate degree for the practice of civil engineering at the professional level are consistent with other learned professions. The body of knowledge gained, and the skills developed in the formal civil engineering education process, are not significantly less than the comparable knowledge and skills in these other professions. Is it reasonable in such complex and rapidly changing times to think that we can impart the requisite engineering knowledge and skills in four years of formal schooling while other learned professions take seven or eight years? Four years of formal schooling were considered the standard for three professions (medicine, law, engineering) 100 years ago, and while medicine and law education lengthened with the growing demands of their respective professions engineering education did not. Perhaps this retention of a four-year undergraduate engineering education has contributed to the lowered esteem of engineering in the eyes of society, and the commensurate decline in compensation of engineers relative to medical doctors and lawyers. Current baccalaureate programs, while constantly undergoing review and revisions, still retain a nominal four-year education process. This length of time limits the ability of these programs to provide a formal education consistent with the increasing demands of the practice of civil engineering at the professional level. There are diametrically opposed forces trying to squeeze more content into the baccalaureate curriculum while at the same time reducing the credit hours necessary for the baccalaureate degree. The result is a production line baccalaureate civil engineering degree satisfactory for an entry level position, but inadequate for the professional practice of civil engineering. The four year internship period (engineer-in-training) after receipt of the BSCE degree cannot make up for the formal educational material that would be gained from a master's degree program. The implementation of this concept will not happen overnight, nor can ASCE will that it be done in a specified time period. This concept is a legacy for future generations of civil engineers. However, perhaps the most important aspect of the implementation of this policy is already in place. Within the U.S. system of higher education, high quality, innovative and diverse master's degree programs currently exist in colleges and universities to support this concept. The active support of this policy by all of the stakeholders in this process, such as the educational institutions, the registration boards, and the various employers of civil engineers, will be required to develop and promote the elements necessary to eventually implement this concept.

Annex VI

European Standing Observatory for the Engineering Profession and Education (ESOEPE)

Agreement

The undersigned Associations agree to set up, for a tentative period of three years, the " **European Standing Observatory for the Engineering Profession and Education"** (ESOEPE).

Preamble

In a discipline which must change constantly to satisfy the demands of our technology-based society, the diversity of engineering degree programmes within Europe is a source of great strength. Nevertheless, as professional engineers become more mobile, society seeks greater assurance of the quality and relevance of provision of engineering programmes: hence, some form of "accreditation" becomes a must.

This agreement is intended to build confidence in systems of accreditation of engineering degree programmes within Europe. It is not intended to harmonise engineering programmes nor accreditation procedures, but simply to assist national agencies and other bodies in planning and developing such systems. It would also facilitate systematic exchange of know-how in accreditation and permanent monitoring of the educational requirements in engineering formation.

Purposes

ESOEPE will:

- facilitate the free exchange of information and provide an effective communication channel for those bodies and individuals throughout Europe concerned with educational and professional standards in Engineering. Such bodies may include government departments, non-government professional organisations, Universities and their Associations, employers and their Associations.
- provide such information as already exists within each country on topics and issues connected with educational and professional engineering standards, for example:
  i. Requirements for Qualification / Recognition / Registration of Engineers;
  ii. Mechanism and routes for Quality Assessment of Engineering education and training courses;
  iii. Basis for syllabuses; attributes of professional engineers intended to be reflected in syllabuses;

iv. Processes of Endorsement/Validation/Accreditation of degree and training courses by existing Agencies established in each country for that purposes

- encourage participation by relevant bodies in as many European countries as possible, all on an equal basis, and to facilitate throughout Europe the development of good practices of Endorsement / Validation / Accreditation and the establishment of Agencies for that purpose.
- facilitate voluntary agreements on accreditation of engineering educational programmes and recognition of engineering qualifications;
- facilitate the development of standards on the competence requirements of graduate engineers.

Bye-laws

The Bye-laws will be developed by the Interim Steering Committee along the lines set below, and submitted for approval at EWAEP3.

1. ESOEPE will be formed by bodies concerned with engineering profession and engineering education, and in particular with quality assurance and accreditation of engineering programmes, including national and trans-national (European) bodies, Associations or temporary networks (e.g. SEFI, FEANI, BEST, E4);
2. The signatories of this "Agreement" will be the initial Members of ESOEPE and will each designate a representative in the "Interim Steering Committee". Up to the first General Assembly, the Interim Steering Committee may accept new Members; later, new Members must be approved by the General Assembly.
3. The "General Assembly" of ESOEPE will be formed by all members. In case of more than one member from one country, they shall have one vote only. New members will be proposed by the Steering Committee and approved by the General Assembly at the beginning of each Session. The General Assembly shall nominate a "Permanent Steering Committee" in charge of running ESOEPE and its website.
4. The "General Assembly" will meet on a regular yearly basis. Possibly, the "management" session will be joined to a public "Workshop" open to discussion and presentations. The "Permanent Steering Committee" will be in continuous contact via e-mail and meet whenever deemed necessary.
5. Participation to the Observatory will be on a "voluntary" basis. Applications for membership should be submitted to the Steering Committee, that will submit it to the General Assembly for approval. A membership fee, aimed at covering the expenses of the Observatory (including the Website), will be charged to Members at the discretion of the Steering Committee.

Website

All participating bodies will transmit their information to the appointed

Webmaster, who will be responsible for entering data and hyperlinks on the site in an approved standard manner and preparing synthetic and/or comparative descriptions if and when deemed appropriate, so that the information will be easily comprehensible and readily accessible to all participants. He will also ensure that all data will be kept up – to - date and take care of running discussion "Fora".

The information transmitted by each participant will cover the following items:

- Name, method of governing and funding of the participating body;
- Administrative particulars regarding the Recognition / Registration / of Engineers in the country of the participating body, including the standards required;
- Particulars of attributes or other requirements prescribed for education and training courses in relation to recognition / registration
- Arrangements for internal Quality Assurance of courses (e.g. evaluation of examination arrangements) and for external assessments;
- Internal and external methods of Endorsement / Validation / Accreditation of academic and training courses in relation to recognition / registration. Details of employers' involvement in the process;
- Lists of Universities and other HEI running endorsed / validated / accredited / engineering degree courses;
- Notes on how Universities are financed, including fees charged to students. Use made by funding bodies of the outcomes of quality assessments;
- Statistics of students entering engineering degree courses and graduating each year, possibly arranged by field (Civil, Mechanical);
- other data at the discretion of each participating body.

The website will take account of the general principles given by Jean Michel in his WFEO paper of September 1997 "Recommendations concerning the Creation, the Development and the Maintenance of a Website".

Signatories of the Agreement

The following Associations have signed the Agreement (through their Representatives indicated in [brackets]) in Paris on 9 September 2000:

- Engineering Council (UK) [A.Ramsay]
- Commission des Titres d' Ingenieurs (FR) [F.Tailly]
- Akkreditierungsagentur für Studiengänge der Ingenieurwissenschaften und der Informatik ASII (DE) [K.Hernaut]
- Ordem dos Engenhieros (PT) [J.M. Ferreira Lemos]
- Collegio dei Presidi delle Facoltà di Ingegneria (IT), promoter of "Sistema Nazionale di Accreditamento in Ingegneria" SINAI [A. Squarzoni]
- Thematic Network "Enhancing European Engineering Education" E4 (EU) [C.Borri]

PART TWO

REPORT OF THE
WORKING GROUP A

Curricula in Civil Engineering Education at Undergraduate Level

Synthesis of Activities Undertaken by the Working Group A

Study on the Organisation of Civil Engineering Education at Undergraduate Level in Europe

Study on the Curricula Structure for the First Civil Engineering Degree in Europe

Iacint MANOLIU
Tudor BUGNARIU

T.U.C.E. Bucharest (RO)

with the participation of:

Ghislain FONDER
University of Liege (BE)
Vaclav KURAZ
C.T.U. Prague (CZ)
Stefan BERGMAN
T.U. Berlin (DE)
Jose-Luis JUAN-ARACIL
U.P. Madrid (ES)
Richard KASTNER
I.N.S.A Lyon (FR)
Pericles LATINOPOULOS
Aristotle University of Thessaloniki (GR)
Antal LOVAS
T.U. Budapest (HU)
Bruce MISSTEAR
Trinity College Dublin (IE)
Vincentas STRAGYS
Vilnius Gediminas T.U. (LT)
Stanslaw MAJEWSKI
S.U.T. Gliwice (PL)
Ryszard KOWALCZYK
University of Beira Interior (PT)
Josef DICKY
S.T.U. Bratislava (SK)
David Lloyd SMITH
Imperial College London (UK)

I SYNTHESIS OF ACTIVITIES UNDERTAKEN BY THE WORKING GROUP A

1. Introduction

The theme "Curricula in civil engineering education at undergraduate level" was defined in the original application for the Thematic Network Project EUCEET as one of the six themes of the project. At the first EUCEET Steering Committee meeting which took place in Paris in December 1998, it was decided to assign this theme to the Working Group A, which together with Working Groups B and C were planned to function in the first two years of the project.

Appointed as Chairman of the Working Group A, Prof. Iacint Manoliu from the Technical University of Civil Engineering of Bucharest prepared the Terms of reference for the WG A which were presented at the meeting of the EUCEET Executive Board held in Paris on 29 January 1999. Endorsed by the Executive Board, the Terms of reference (see Annex I) were then presented at the First EUCEET General Assembly in Barcelona. At the same time, the Chairman of the Working Group A prepared the draft of the Questionnaire needed for the survey on the civil engineering education at undergraduate level across Europe, having as a model the Questionnaire used previously for a similar purpose in the TNP EUPEN (European Physics Education Network) coordinated by Prof. Henrik Ferdinande (Universiteit Gent).

The Working Group A was formed and started to function at the Barcelona General Assembly. From its very first meeting, it became obvious the great interest of a large number of the academic partners toward the activities of the WG A. The representatives of the partner institutions, as they were nominated at the General Assembly, contributed with their presence and their active involvement between these meetings, expressing opinions and ideas on the Working Group’s activity, distributing and collecting the questionnaires and providing all necessary information about the national peculiarities of civil engineering education systems.

It was decided to have all meetings of the WG A connected with meeting of the Steering Committee. By this way, not only the members of the Working Group could attend the meetings of the WG A but also other colleagues, who brought their contribution to the discussion of various materials.

In the table I.1 is summarised the attendance of the five meetings by the members of the Working Group A. In the table I.2 is summarised the attendance of the same meetings by other participants in the project.

Members of Working Group A *

Table I.1

CRT NR	NAME	INSTITUTION	CNTR	ATTENDANCE OF THE MEETINGS				
				BARCELONA	LONDON	LYON	ODENSE	PRAGUE
				21-22.02.99	17-18.07.99	28-29.02.00	18-20.05.00	20-21.07.00
0	1	2	3	4	5	6	7	8
1	Ghislain FONDER	University of Liege	BE	•	•	•	•	•
2	Jean-François THIMUS	Université Catholique de Louvain	BE	•		•		
3	Vaclav KURAZ	C.T.U. Prague	CZ	•	•	•	•	•
4	Jiri VASKA	AECEF Prague	CZ		•		•	
5	Ladislav LAMBOJ	C.T.U. Prague	CZ		•		•	
6	Josef MACHACEK	AECEF Prague	CZ		•		•	•
7	Hynek SERTLER	University of Pardubice	CZ				•	•
8	Stefan BERGMAN	T.U. Berlin	DE		•	•		•
9	Jose-Luis JUAN-ARACIL	U.P. Madrid	ES		•	•	•	•
10	Pedro DIEZ	U.P. Catalunya	ES	•		•		
11	Richard KASTNER	I.N.S.A. Lyon	FR	•	•	•	•	•
12	Jean-Paul MIZZI	E.N.T.P.E. Lyon	FR			•	•	
13	Pericles LATINOPOULOS	Aristotle University of Thessaloniki	GR	•	•	•	•	
14	Antal LOVAS	T.U. Budapest	HU	•	•	•	•	•
15	Istvan BODI	T.U. Budapest	HU		•		•	•
16	Bruce MISSTEAR	Trinity College Dublin	IE	•	•	•	•	•

* Countries in alphabetical order

Table I.1 (continued)

0	1	2	3	4	5	6	7	8
17	Vicentas STRAGYS	T.U. Vilnius	**LT**	●	●	●	●	●
18	Juris NAUDZNUS	Riga Technical University	**LV**				●	●
19	Helena WASMUS	Delft University of Technology	**NL**			●	●	
20	Wojciech GILEWSKI	Warsaw University of Technology	**PL**			●	●	●
21	Andej LAPKO	Bialystok Technical University	**PL**				●	●
22	Stanislaw MAJEWSKI	S.U.T. Gliwice	**PL**	●	●	●	●	●
23	Ryszard KOWALCZYK	University of Beira Interior	**PT**	●	●	●	●	●
24	Luis LEMOS	Coimbra University	**PT**	●			●	
25	Iacint MANOLIU	T.U.C.E. Bucharest	**RO**	●	●	●	●	●
26	Tudor BUGNARIU	T.U.C.E. Bucharest	**RO**	●	●	●	●	●
27	Paulica RAILEANU	T.U. Gh. Asachi Iasi	**RO**	●			●	
28	George BARSAN	T.U. Cluj- Napoca	**RO**	●			●	
29	Josef DICKY	S.T.U. Bratislava	**SK**	●	●		●	●
30	David Lloyd SMITH	Imperial College London	**UK**	●	●	●	●	●

Other participants to Working Group's A meetings *

Table I.2

CRT NR	NAME	INSTITUTION	CNTR	ATTENDANCE OF THE MEETINGS				
				BARCELONA	LONDON	LYON	ODENSE	PRAGUE
				21-22.02.99	17-18.07.99	28-29.02.00	18-20.05.00	20-21.07.00
1	Yveta LINHARTOVA	University of Pardubice	CZ					•
2	Peter RUGE	T.U. Dresden	DE			•		
3	Joerg FRANKE	T.U. Berlin	DE	•				
4	Thomas LAUR	Tallinn Technical University	EE				•	
5	Jacques LERAU	I.N.S.A. Toulouse	FR	•	•			
6	Marie-Ange CAMMAROTA	E.N.P.C. Paris	FR	•	•	•	•	
7	Leone CORRADI	Politecnico di Milano	IT				•	
8	Giovani BARLA	Politecnico di Torino	IT				•	
9	Algirdas CIZAS	T.U. Vilnius	LT		•			
10	Juris SMIRNOVS	Riga Technical University	LV				•	
11	Eivind BRATTELAND	Norwegian University of S & T	NO			•		
12	Joao HIPOLITO	IST Lisbon	PT		•			
13	Nicoleta RADULESCU	T.U.C.E. Bucharest	RO	•	•	•	•	
14	Miron PAVLUS	T.U. Kosice	SK				•	
15	Ban Seng CHOO	University of Nottingham	UK			•	•	

* Countries in alphabetical order

2. Meetings of Working Group A

As one could expect, a great deal of the activities required in order to accomplish the objectives of the WG A were undertaken by using electronic mail. No matter how useful was the virtual mobility, the working meetings of the Group proved to be extremely precious. Therefore, it is worth to summarise in what follows the topics under discussion and the decisions adopted at the meetings.

FIRST MEETING of the Working Group A
Barcelona, U.P. de Catalunya, 23 February 1999

- The draft of the Questionnaire of Working Group A, prepared by Prof. Manoliu and distributed to the participants of the General Assembly in Barcelona was discussed, modified according to the opinions of participants and approved. The Chairman and his colleague Tudor Bugnariu assumed the task of giving the final form of the questionnaire (see Annex I), taking into consideration all changes adopted in the meeting, and to distribute it to all EUCEET partners by the end of March 1999 both by mail and e-mail.

- The following members of the working group were nominated to serve as contact person of the WG in their respective country, in order to distribute the questionnaire and to collect the answers from as many institutions as possible outside the EUCEET network:

  David Lloyd Smith for U.K.
  Bruce Misstear for Ireland
  Richard Kastner for France
  Jörg Franke for Germany
  Pedro Diez for Spain
  Luis Lemos for Portugal
  Jean - François Thimus for Belgium
  Pericles Latinopoulos for Greece
  Antal Lovas for Hungary
  Vaclav Kuraz for Czech Republic
  Josef Dicky for Slovakia
  Tudor Bugnariu for Romania
  Stanislaw Majewski for Poland
  Vicentas Stragys for Lithuania

- Participants agreed to set up 15 June 1999 as the deadline for the answers to the questionnaire.

- Dr. David Lloyd Smith announced that the Department of Civil Engineering at Imperial College London is willing to host the next meeting of the working Group A. The meeting was called for Monday 26 July 1999 at Imperial College, London.

SECOND MEETING of the Working Group A
London, Imperial College, 26 July 1999

- State-of-the-art of sent EUCEET questionnaire and of received answers was presented by the Chairman of Group A, Prof. Iacint Manoliu. The final form of the questionnaire, agreed at the meeting in Barcelona, was sent to all partners by post and, in the mean time, a template file and an example were sent by e-mail.

- Conclusions drawn from the state-of-the-art:

- Out of a total number of 50 academic partners (42 in the first year and 8 beginning with the second year), only 30 answers were received before the meeting in London (27 from first year partners and 3 from second year partners). From other institutions in Europe, not partners in EUCEET, 36 answers were received. Thus, the total number of received answers was 66. Out of a total of 30 answers received from EUCEET partners, 26 were complete, from which 16 sent by e-mail and 14 by post. From 36 answers received from other institutions, 20 were complete, from which only 9 sent by e-mail. Generally, the lack of completeness of the answers referred to the second part of the questionnaire, regarding the curricula information.

- Until the meeting in London, several important countries represented in the EUCEET program did not send any answers to the questionnaire. Representatives attending the meeting promised to take appropriate measures.

- It was emphasised the importance of sending the completed answers by e-mail to the contact person in Bucharest (Assoc. Prof. Tudor Bugnariu) for easier treatment of data.

- Prof. Iacint Manoliu made a proposal for curricular categories, as starting point for in-depth analysis concerning the European comparison among civil engineering curricula at undergraduate level:

- There were proposed 7 categories (A to G) based on curricular content and compulsory/optional disciplines: Basic Sciences; General Engineering Sciences; Specialised Engineering Sciences; In-depth Specialised Engineering Sciences; Economics and Management Studies; Humanities, Social Sciences and

Languages; Field Work. For each category there were exemplified some important disciplines.

- It was agreed about this general classification, with some proposals (amendments) from Working Group members, concerning more suggestive titles for categories and the disciplines (subjects) assigned to each category. Because of the variety of final assessment (the Final Project), noticed from the received answers, this was introduced as a separate category.

- After discussions, the Working Group members agreed on the following final classification of the disciplines (subjects) in the curriculum at undergraduate level:

Table I.3

Category	Name of category	Examples of subjects
A	**Basic Sciences**	Mathematics, Physics, Chemistry
B	**Engineering Sciences**	Mechanics, Strength of materials, F.E.M., Computer science, Drawing-graphics
C	**Core Civil Engineering Subjects**	Statics, Dynamics, Hydraulics, Soil Mechanics, Fluid mechanics, Elasticity & Plasticity, Building materials, Surveying, Reinforced concrete, Hydrology
D	**Engineering Specialisation**	Steel structures, Reinforced concrete structures, Foundation Engineering, Earthquake engineering, Non-linear design of structures, Hydraulic systems in transitory regime, Hydraulic structures
E	**Economics and Management subjects**	
F	**Humanities, Social sciences, Languages and Physical Education**	
G	**Field Work**	
H	**Final Project**	

- It was agreed to ask each respondent to assign himself the subjects in the curriculum to the categories A … F specified above (based on already sent answers). Thus, to all partners (and to other institutions which already responded), an additional table will be sent by the end of September, containing the column required for this additional information.

- Assoc. Prof. Tudor Bugnariu (T.U.C.E. Bucharest) presented an example of preliminary analysis, regarding the curricula structure and the organisation of studies.

- Three universities with a 5-year program and two universities with a 4-year program from five different countries were selected and tables and charts reflecting total number of teaching hours vs. categories, as mean value computed for selected answers, were presented.

- For each university in the selection, evolution of curricula content: total teaching hours vs. categories and academic year.

- For each academic year, the distribution of categories vs. teaching hours, as mean value per selected universities.

- For each university in the selection, total teaching hours vs. academic year.

- Finally, Assoc. Prof. Tudor Bugnariu presented some examples of preliminary analysis regarding the organisation of studies based on 23 complete answers from first year partners. The main topics were related to: the formal duration in years; the official academic calendar; the inflow of students and entry requirements; mean typical age of students; mean percentage of female students; the student/academic stuff ratio; average success rate in the last academic year; the outflow of students; degree courses in other languages contained in the curriculum.

- Discussions on data processing and the interpretation of the answers.

- It was proposed and agreed to have the questionnaire completed with a question referring to the exchange of students (number of students received and sent by the institution in one academic year; duration of study period for the student mobility; learning agreement between the sending/receiving institutions; recognition of study period abroad, etc). Thus, a second questionnaire was adopted, containing these informations and the category assignment discussed before (see Annex I).

- Prof. Gareth Jones from the Department of Physics, Imperial College, made a presentation on trends in European higher education, following the Bologna Conference and informed about the activities of the Thematic Network for Physics (EUPEN) in which he was involved.

- Discussions on the future activity of the Working Group A in the period July 1999 - May 2000 (second EUCEET General Assembly).

- The following schedule was agreed:

30 September 1999	-	Second questionnaire finalised and sent to all partners.
15 December 1999	-	Deadline for receiving answers, for both first and second questionnaires.
20 February 2000	-	First draft on analysis of the answers received for the questionnaires.
28-29 February 2000	-	Third meeting of the Working Group A to discuss and improve the draft of the analysis (I.N.S.A., Lyon).
18-20 May 2000	-	Second General Assembly of EUCEET and the 4th meeting of Working Group A (Engineering College, Odense).

THIRD MEETING of the Working Group A
Lyon, I.N.S.A., 28 - 29 February 2000

- Presentation of the Civil Engineering Department of I.N.S.A Lyon, by Prof. Jean-Marie Reynouard, Head of Department.

- State-of-the-art of received answers to EUCEET questionnaires, presented by Assoc. Prof. Tudor Bugnariu. The list of received answers and a summary of the information were included in summarising tables.

- Comments about the possible processing of the received data, regarding the first part of the questionnaire: organisation of studies. Assoc. Prof. Tudor Bugnariu presented cumulative tables and example tables with processed data.

- Discussions on the presented tables. Opinions expressed by the Working Group members regarding their possibility to correct the answers. In this context, it was suggested that every partner should receive the cumulative table for a final assessing of the own answer.

- State-of-the-art of received answers to the second questionnaire, about the assignment of disciplines to categories A to H as they were defined at the previous meeting, presented by Assoc. Prof. Tudor Bugnariu. Regarding the proposal to assign different codes to disciplines categories (in order to in-depth refinement of analysis), the general opinion was that the category assignment is enough for general processing, in order to emphasise the evolution of curricula between different study years and to asses the compatibility of curricula among various institutions.

- Discussions on total contact hours assessment for each category, based on some examples. It was agreed that for the final report, all specialisation occurring in the last 1 - 2 years of a curriculum should be treated as separate answers.

- Prof. Iacint Manoliu summarised the decisions adopted by the Working Group A and the future tasks until 31 August 2000, end of the second year of the project:

- Sending to all partners the cumulative tables referring to the first part of the questionnaire, to be checked - deadline 10 March 2000;
- Sending to all partners the tables with curricula subjects, with total contact hours per category, to be checked - deadline 10 March 2000;
- Receiving answers from all partners - deadline 31 March 2000;
- Preparing of draft reports on both part I and part II of the questionnaire, to be presented at the General Assembly in Odense, on 18 May 2000.
- Preparing the revised form of the reports for the part I and part II of the questionnaire, taking into consideration proposals and amendments made at the General Assembly in Odense.
- Meeting of Working Group's A core members in Prague on 20 - 22 July 2000, to discuss the revised form of the reports and to agree on the final form for publication and dissemination.

FOURTH MEETING of the Working Group A
Odense, Engineering College, 18 - 20 May 2000

- State-of-the-art of activities of Working Group A, presented in the framework of the General Assembly of EUCEET. Presentation made by Prof. Iacint Manoliu and Assoc. Prof. Tudor Bugnariu.

- Presentation of the main features of the higher education reform in Italy and its impact on Civil Engineering education, by Prof. Giovani Barla, from Politecnico di Torino.

- Comments, questions and discussions.

FIFTH MEETING of the Working Group A
Prague, C.T.U., 20 - 22 July 2000

- Results of data processing regarding the first part of the EUCEET questionnaire (organisation of studies), as they resulted from the received answers. The presentation was made by Assoc. Prof. Tudor Bugnariu.

- Comments and discussions about the presented tables and charts. All common opinions where notified in order to be used in the Final Report of Working Group A.

- Results of data processing regarding the second part of the EUCEET questionnaire (curricula structure, category assignment, etc.), presented by Assoc. Prof. Tudor Bugnariu.

- Discussions on the presented tables and charts. Some members of the Working Group expressed their availability to do some other processing of the data, in order to get additional conclusions. In this context, it was suggested and agreed to send the whole database and the cumulative tables recorded on a CD to all members of the Working Group present at the meeting.

- Discussions about the content and presentation of the National Reports on Civil Engineering Education.

- Discussions about the content and editing form of the Final Report of Working Group A.

- Prof. Iacint Manoliu summarised the decisions adopted by the Working Group A and the future tasks until 31 August 2000, end of the second year of the EUCEET project and 31 December 2000, when Reports produced by the Group should be sent to the publisher.

3. Outcomes and follow-up of the activities of Working Group A

The main outcomes of Working Group's A activity are the completed answers to the questionnaires, received from institutions across Europe. All the responses received by e-mail (as attached files) built the EUCEET database, to be disseminated by CDs. The state-of-the-art of the received answers, in July 2000, before the last meeting in Prague, is summarised in table I.4.

As previewed in the Terms of reference, the Survey on Curricula in civil engineering education at undergraduate level, based on the responses to the comprehensive Questionnaire, gave to the Working Group A the possibility to produce two studies:

- Study on the organisation of civil engineering education at undergraduate level in Europe.
- Study on the curricula structure for the first civil engineering degree in Europe.

The two studies are included in Sections II and III of this Report.

Efforts were made to extract from the received answers the most relevant data. However, there is still a tremendous amount of information worth to be presented and analysed, but for which room could not be available in this publication. In the attempt to better put into value this information, the members of the Working Group A decided to prepare in 2001 a special volume dedicated to civil engineering programmes and curricula in Europe which will comprise all National Reports sent by the members of the Group, complete curricula of various universities, lists of institutions offering civil engineering education and other pertinent information. The monograph, the first of this kind for civil engineering education worldwide, will represent a very good follow-up of the intense activity undertaken by the EUCEET Working Group A.

Annex I

WORKING GROUP A

Curricula in Civil Engineering Education at Undergraduate Level

TERMS OF REFERENCE

The main objective of the Working Group A is to conduct **a survey on the civil engineering education at undergraduate level across Europe**.

The survey will be based on a *questionnaire* about first Civil Engineering degree. The *questionnaire* will be built in four different entities:

I. General information about the Civil Engineering programme in each institution (name of the institution and of the faculty/department; type of diploma; duration of studies; calendar of the academic year; ECTS; languages etc.) and on the organisation of studies.

II. Information about the structure of the studies in tabular form, i.e. (a) subjects (course units) thought in each semester/year, (b) (compulsory or optional), (c) ways of teaching (lectures, laboratories, seminars, projects, etc.) and (d) examination (assessment) systems.

III. Inflow and outflow of students, financial aspects - fees, fellowships, cost per student etc.

The analysis of the *questionnaire* return will lead to the preparation and publication of two comprehensive studies:

1. Study on the organisation of civil engineering education at undergraduate level in Europe.
2. Study on the curricula structure for the first civil engineering degree in Europe.

The *questionnaire* will be sent to all universities members of the EUCEET Thematic Network and, through them, to other universities in Europe offering civil engineering education. In order to get a picture as complete as possible of the civil engineering education in Europe at undergraduate level, the questionnaire will be also distributed among universities from countries not yet eligible for partnership under the SOCRATES - ERASMUS programme.

Tentatively, the activity plan of the Working Group A is as follows:

- First WG A meeting and launching of the *questionnaire*: 22 - 23 February 1998, Barcelona.
- WG A meetings for the analysis of the returns to the inquiries: July 1999, February 2000.
- Presentation of the results of the *questionnaire*: EUCEET General Assembly, May 2000.
- Publication of the comprehensive studies: December 2000.

Table I.4 State-of-the-art of the received answers - July 2000

	TOTAL NO. OF INSTITUTIONS	QUESTIONNAIRE 1			QUESTIONNAIRE 2	
		RECEIVED ANSWERS	COMPLETE ANSWERS	E-MAIL ANSWERS	RECEIVED ANSWERS	E-MAIL ANSWERS
1ST YEAR PARTNERS	42	40	30	32	28	28
2ND YEAR PARTNERS	7	7	5	6	4	4
3RD YEAR PARTNERS	10	10	7	7	7	7
OTHER INSTITUTIONS	55	55	33	40	5	5
TOTAL	114	112	75	85	44	44

EUCEET QUESTIONNAIRE

ABOUT CIVIL ENGINEERING EDUCATION AT UNDERGRADUATE LEVEL IN EUROPE

0. GENERAL INFORMATION ON THE INSTITUTION AND ON THE ORGANIZATION OF STUDIES

0.0. INSTITUTION

0.0.1	**Name of the institution in local language and in English translation (if applicable)**	
0.0.2	**ERAMUS/SOCRATES code**	
0.0.3	**Name of the Faculty/Department/ Division (running the degree course)**	
0.0.4	**Street address (in national language or in English)**	
0.0.5	**City (in English)**	
0.0.6	**Postal Code**	
0.0.7	**Country (in English)**	
0.0.8	**Telephone / Fax**	
0.0.9	**WEB Site of the Institution**	

0.0.9.1	**Does the www site contain information on the undergraduate studies ?**	YES/ NO

0.1. CONTACT PERSON FOR THE EUCEET NETWORK

0.1.1	**Last and first name of the contact person for EUCEET network**	
0.1.2	**Position in the institution of the contact person**	
0.1.3	**Telephone of the contact person**	
0.1.4	**Fax of the contact person**	
0.1.5	**E-mail of the contact person**	

0.2. RESPONDENT FOR THE EUCEET QUESTIONNAIRE *

0.2.1	**Last and first name of the respondent**	
0.2.2	**Position in the institution of the respondent**	
0.2.3	**Telephone of respondent**	
0.2.4	**Fax of the respondent**	
0.2.5	**E-mail of the respondent**	

***** Only if different from the contact person

0.3. QUALIFICATION

0.3.1	**Name of the qualification**	
	Formal (legal) duration (years)	
	Average actual duration (years)	

0.4. CALENDAR INFORMATION

0.4.1	**The official academic calendar is**	
	Annual with exams at the end of the year	
	In two semesters with exams at the end of each semester	
	Other (specify *)	

	Teaching period - duration **	Total teaching weeks	Total weeks for exams preparation	Total exam weeks
0.4.2				
	Year			
	Semester 1			
	Semester 2			
	Term 1			
	Term 2			
	Term 3			
	Module 1			
	Module 2			
	Module 3			
	Module 4			
	……..			

0.5. INFLOW OF STUDENTS – ENTRY REQUIREMENTS

0.5.1	**Is entry to Engineering Courses restricted in any way ?**	YES/NO

0.5.1.1	**If “YES”, tick or select the main criteria in order starting with "1"**	
	a. Selection by school results	
	b. Selection by state examination results	
	c. Selection by university examination	
	d. Selection by interview	
	e. Selection by any other arrangements (specify *)	

* Details in the box bellow
** See Note 0.4.2 in guidelines

0.5.1.2	**If "YES", what is the percentage of success ?** (number of students accepted/number of candidates %)	

0.5.2	**Is there a common entry for all Engineering Courses?**	YES/NO

0.5.2.1	**If "YES", at what stage will be done the selection for Civil Engineering Degree Courses** (tick in the right box)**?**	
	a. after 1 year	
	b. after 1.5 years	
	c. after 2 years	
	d. others (specify *****)	

0.5.3	**Is the number of entry places in the Civil Engineering Department limited ?**	YES/NO

0.5.3.1	**If "YES", what is the inflow number of students enrolling in Civil Engineering in each of the last five academic years ?**	1993-1994	
		1994-1995	
		1995-1996	
		1996-1997	
		1997-1998	

0.5.3.2	**If "NO", what is the inflow number of students enrolling in Civil Engineering in each of the last five academic years ?**	1993-1994	
		1994-1995	
		1995-1996	
		1996-1997	
		1997-1998	

0.5.4	**What is the typical age of students on entry ?**	years

0.5.5	**What is the percentage of female students enrolled in Civil Engineering Degree Courses in the past five years?**	%

0.5.6	**What is the student / academic staff ratio in the Civil Engineering Department ?**	

0.6. PROGRESS OF STUDENTS

0.6.1	**Specify the system used for allowing students to progress from one academic year to the next one** (tick in the right box)	
	a. after fully completing the obligations specified in the curriculum	
	b. after obtaining a minimum number of credits	
	c. by jury decision	
	d. others (specify *****)	

***** Details in the box bellow

0.6.1.1	**If progress is allowed by credit accumulation, how many credits are required / total number in each year ?**	/

0.6.1.2	**If progress is allowed by jury decision, how many requirements specified in the curriculum should be completed / total number in each year *?**	/

0.6.2	**Average success rate (in %) of those actually taking the exam, in the academic year 1997/1998, during the**				
	1st YEAR	2nd YEAR	3rd YEAR	4th YEAR	5th YEAR

**	

0.6.3	**Total number of students registered in the department during the academic year 1998/1999**				
	1st YEAR	2nd YEAR	3rd YEAR	4th YEAR	5th YEAR

0.6.4	**Total number of foreign students registered in the department during the academic year 1998/1999**				
	1st YEAR	2nd YEAR	3rd YEAR	4th YEAR	5th YEAR

0.7. OUTFLOW OF STUDENTS (graduates of the 1997/1998 class)

0.7.1	**Percentage of students (%) completing their studies in the**			
	official length of time	+ 1 YEAR	+ 2 YEARS	+ MORE YEARS

0.7.2	**Percentage of students leaving the department before completing their studies**	%

0.7.3	**Is there a maximum permitted duration of studies?**	YES/NO

0.7.3.1	**If “YES”, how many semesters/years ?**	

* Mention in the box bellow other criteria if this ratio is meaningless

** Any other relevant information regarding the progress of students

0.7.4	**Based on the data recorded in the last 5 years, what is the distribution per age of the graduates** (number of students) **?**								
	Age	21	22	23	24	25	26	27	>27
	1993-1994								
	1994-1995								
	1995-1996								
	1996-1997								
	1997-1998								

0.8. EXAMINATIONS - RESIT/REPEAT EXAMS

0.8.1	**Is there a second chance to repeat exams within the same academic year?**	YES/NO
	Is the repeat chance unlimited ?	YES/NO

0.8.2	**If a student fails the examination of a certain course unit, he/she**	1st YEAR	2nd YEAR	3rd YEAR	4th YEAR
	- is allowed to proceed if the overall mark is satisfactory				
	- may repeat the exam for this course unit				
	- is obliged to repeat the whole semester/year				
	- has no right to continue the studies				
	- others (specify *)				

0.8.3	**How many times may a student repeat a**	1st YEAR	2nd YEAR	3rd YEAR	4th YEAR	5th YEAR
	- course unit ?					
	- semester ?					
	- year ?					
	- others (specify *) ?					

0.9. FINAL ASSESSMENT OF THE DEGREE

0.9.1	**The final assessment is based on** (tick in the right box) **:**	
	a. the fulfilling of all the requirements in the curriculum	
	b. the accumulation of a specified number of credits	
	c. a final examination	
	d. a diploma project	
	e. others (specify *)	

* Details in the box bellow

0.10. ECTS CREDITS (only if allocated)

0.10.1	**If ECTS credits have been allocated to each course unit, please tick in the right box**	
	If a local credit system exists (specify *)**, please tick in the right box**	

0.11. LANGUAGE OF THE INSTITUTION

0.11.1	**What is the normal language of instruction in your institution ?**	

0.11.2	**Are some course units available in other languages?**	YES/NO

0.11.2.1	**If "YES", which language(s) ?**	

0.113	**Is there a degree course offered in other languages?**	YES/NO

0.11.3.1	**If "YES", which language(s) ?**	

* If possible, write in the box bellow the conversion rules to the ECTS credits or sent enclose a conversion table

1. INFORMATION ON THE CURRICULUM

1.1. FIRST YEAR *

1.1.1 COURSE UNITS

Crt Nr.	Name of course unit	Type C/OP	Total hours	From which spent in **					Assessment			Relative weight (%)		ECTS Credits
				L	CL	LAB	P	TT	Exams			Cont. Assmt.	Exam	
									W	O	W&O			
i		OPi												

Optional Courses ***		
i		OPi

1.1.2 OTHER ACTIVITIES

Nr.	Description	Total hours/year	ECTS Credits
	Placements / field work		
	Others		

* Similar tables for each academic year from 2 to 5 (parts 1.2 to 1.5 of the questionnaire), beginning with the top of the page

** L = lectures; CL = class work; LAB = laboratory work; P = project; TT = tutorial; W = written; O = oral; W&O = written and oral.

*** For each current number "i" representing an optional course, please complete separate tables with all other correspondent options

2. FURTHER INFORMATION

2.1	**Please list below any additional information relating to specific questions where you wish to add further comment or explain why the question is difficult to answer.**

2.2	**Are there any atypical teaching system characteristics that make replies for your institution (country) difficult?**

2.3	**Is there any other significant information that was not addressed in the questionnaire?**

2.4	**Date of completion**	

GUIDELINES FOR COMPLETING THE EUCEET QUESTIONNAIRE

The following **notes** are given for certain questions where the meaning may be unclear in different countries.
In order to avoid confusion, a **glossary** of the various terms (assessment, course unit, degree course, contact hours, hour, etc.) is added as to define precisely the meaning of each term.

NOTE for 0.3

Several first-degree qualifications may be available. If in a given institution, there are offered degree courses leading to a different qualification, **a different questionnaire form should be completed for each degree course**. If in a given institution, several degree courses leading to the same qualification are offered, **a different questionnaire form should be completed for each course**. In order to avoid redundancy, data referred to parts which are common (e.g. "cycle I" or "common tronc" etc.) will be given only once.

NOTE for 0.4.2

To complete only parts of the table of relevance for the given degree course (year/semester/term/module).

NOTE for 0.6.2, 0.6.3, 0.6.4

In order to use the questionnaire returns for defining also some trends in European Civil Engineering education, respondents are kindly invited to provide the information in tables 0.6.2 to 0.6.4 for the previous 5 years (by repeating the tables).

NOTE for 1.1.1, 1.2.1, 1.3.1, 1.4.1 or 1.5.1

Please list all the course units which are **compulsory** (C) or **optional** (OP) in the year concerned. In the case a student has to make a choice of one or some course units out of a set of optional course units, please, write in the third column : “OP 1" (out of a set of …… course units), and number further the other choices. Please give separate lists of all the available optional course units for each option on separate tables.
Special attention should be given to the meaning of the word **“hour”** (see glossary for details)

NOTE for 1.1.2, 1.2.2, 1.3.2, 1.4.2 or 1.5.2

Please give details on the content of the activity. This is particularly important for a project work in the last semester (final project, diploma project, etc).

GLOSSARY FOR THE EUCEET QUESTIONNAIRE

The glossary is intended to provide a definition of the terms used in the questionnaire. Please use this meaning when completing the document, even if it has a different meaning to you.
Where a number of alternative terms are given in the glossary, the first one is the preferred and the others are equivalents.

ASSESSMENT

The total range of written, oral and practical tests used to decide on the student's progress in the degree course.

BACHLORS DEGREE

First degree in some countries but also used for lowers level qualifications.

CIVIL ENGINEERING DEPARTMENT

School/Faculty/Department/Division of University that runs the degree on a day to day basis.

CLASSWORK

See PROBLEM CLASS

COMPREHENSIVE EXAM

A general written or oral exam, usually taken at the end of one or more years of the degree course. It will cover a large range of different topics and is not linked to particular course units.

CONTACT HOURS

Hours specified in the curriculum (usually 26...32 per week) for didactic activities such as lectures, class works, laboratory works, projects etc. at which the presence of one or several members of the staff in the classroom is required.

CONTINUOUS ASSESSMENT

A number of written, practical or oral tests taken during the teaching period and used to monitor student progress and contribute to the overall assessment of the course unit on the presence of the teaching staff.

COURSE

[Term to be avoided unless meaning is clear from context]

Either COURSE UNIT or DEGREE COURSE.

COURSE UNIT or COURSE

The basic division of the degree course, usually taken by one lecturer. Typically there will be between about 8 and 12 per year and they will last part or all of the academic year. Usually associated to a number of credits.

CREDITS

(See also ECTS CREDITS)
A number which specifies the size or academic value of a course unit. Usually course units totaling a specified number of credits must be passed to successfully complete a semester, academic year or degree course. A variety of credit systems exist in Europe.

DEGREE or DEGREE COURSE or QUALIFICATION

University qualification taken by student intending to become a civil engineer. Formal (legal) duration 3 to 5 years.

DEGREE COURSE

See DEGREE

DEPARTMENT

See CIVIL ENGINEERING DEPARTMENT

DIPLOMA PROJECT

A project to be done by the student at the end of the degree. The student is expected to carry out a design or a research work, either individually or in a group.

ECTS CREDITS

(See also CREDITS)
European Community Course Credit Transfer System.
A system for comparing the workload of students across Europe, based on the allocation of 60 credits for 1 (legal) year of study. This system is based on the idea that each year study in a European university is equivalent and should be recognized as such.

EXAM

Formal written and or oral test taken at the end of a course unit or later in the academic year.
Note : Tests within the course unit are classed as continuous assessment.

EXAMPLES CLASS

See PROBLEM CLASS

FIELDWORK

See PLACEMENT

HOMEWORK

Work set by an academic to be done by the student outside scheduled university teaching hours. It may consist of problems to be solved and handed in or elaboration of a project etc.

HOUR

Periods of 60 minutes contact between a staff member with a group of students. Where a lecture (or another kind of didactic activity) period is in the range of 45/55 minutes, it can be also considered as an hour. Longer periods however should be expressed in an equivalent number of hours.

LABORATORY

Practical experimental class where the students are active and supervised by a staff member and/or assistants.

LECTURE

Theory (basic concepts or facts) or examples class taken by a lecturer with the entire class. In this situation the students are totally passive.

MODULE

Unit of an academic year smaller then a term (year may be unequally divided).

PLACEMENT or FIELDWORK

Period of several weeks to months spent by the student working in a construction company, design office, research institute or other organization outside the normal university environment.

PROBLEM CLASS

Class in which the lecturer or an assistant shows how to do a problem associated with a particular lecture(s). Students may be either passive or active/guided.

PROJECT

Design work carried out by students partly in the class (contact hours) and partly as homework.

QUALIFICATION

See DEGREE

SEMESTER

Half an academic year (usually with exams at the end)

SEMINAR

A class where the teacher and/or the students expose and discuss a particular topic or subject.

SMALL GROUP TEACHING

See TUTORIAL

SUCCESS

Students who pass a semester/year after a first, second or even a third attempt within the same academic year, should be regarded as successful in that year.

TEACHING HOURS

See CONTACT HOURS

TERM

Third of an academic year (year may be unequally divided.)

TUTORIAL or WORKSHOP or SMALL GROUP TEACHING

Class with a relatively small number of students per staff member, usually involving problem solving. Students are expected to take an active part.

TYPICAL

Average over the last five academic years

UNDERGRADUATE LEVEL EDUCATION

Education with a minimum duration of 3 years

UNIVERSITY

Institution that provides the civil engineering course (e.g. Technical University, University, Grande Ecole, Institut, Fachhochschule etc.)

WORKSHOP

See TUTORIAL

EUCEET QUESTIONNAIRE - SUPPLEMENTARY INFORMATION
(Two pages)

Name of the institution in local language and in English translation (if applicable)	
Name of the Faculty/Department/ Division (running the degree course)	
City (in English)	
Country (in English)	
Last and first name of the respondent	
Position in the institution of the respondent	
E-mail of the respondent	

0.12. STUDENTS EXCHANGE BETWEEN CIVIL ENGINEERING UNIVERSITIES

0.12.1	Number of students involved in the students exchange programme	
	Number of foreign students received in the last academic year	
	Number of students sent abroad by the institution in the last academic year	
	Comments in the box below	

0.12.1	**Duration of studies in the student exchange programme**	
	Duration of studies for the received students	
	Duration of studies for the sent students	
	Comments in the box below	

0.12.3	**Are there any agreements between sending/receiving institutions regarding the recognition of study period? Please give details in the box below.**	YES/NO

3. COURSE UNITS ASSIGNMENT TO CATEGORIES

3.1. FIRST YEAR *

Crt Nr.	**Name of course unit.** Please complete this table with the course units in the same order as in the initial questionnaire.	Category

* Similar tables for each academic year from 2 to 5 (parts 3.2 to 3.5 of the questionnaire). If necessary, insert new rows in the table.

II STUDY ON THE ORGANISATION OF CIVIL ENGINEERING EDUCATION AT UNDERGRADUATE LEVEL IN EUROPE

The main topics proposed by the EUCEET questionnaire were analysed on the basis of university returns, in order to obtain a wide picture on the organisation of civil engineering education across Europe.

The main sources of information were the completed questionnaires and additional data provided by EUCEET partners. It must be emphasised the importance of the Working Group's meetings and the mail and e-mail contacts between its members, as complementary sources of information, corrections or conclusions.

As far as the reliability of the received answers, it must be stressed that for some institutions data are incomplete and erratic. Some of the answers show a misunderstanding of the questions. Important differences are noticed between the number of answers received from various countries and between the size of institutions (in terms of the number of enrolled students). Unfortunately, not all answers arrived as e-mail attached files, in order to be included in the EUCEET database.

When drawing conclusions from this analysis, one must take into account the number of received answers (only 112), their scattered distribution per countries (therefore, difficult to be considered as a "statistical population") and all the problems mentioned before.

Organisation of civil engineering studies was analysed following the main topics of the EUCEET questionnaire. All relevant data were copied in Excel tables, with each line assigned to a received answer (institution). The column number corresponds to the question order. For each question, the spreadsheet was then sorted according to the most relevant conclusion. The average of data, when calculated, was taking into account only the expressed answers to the specific question. Mean values per countries were also calculated only by number of relevant answers, disregarding the size of institution (as number of enrolled students). The summarising table with all received answers is listed in Annex II.

1. Duration of studies and types of programmes

The survey confirmed the existence in the civil engineering education in Europe of two basic systems:

- the continental system;
- the anglo-saxon system.

The continental system is characterised by two programmes put in parallel:

- of long duration (4.5 – 5 – 6 years);
- of short duration (3 – 3.5 – 4 years).

In the anglo-saxon system, the programmes are put in a ladder. The first step is of 3 – 4 years duration in UK, leading to a Bachelor of Engineering (Bachelor of Science) or to a Master of Engineering Degree (only when of 4 years). In Ireland, most civil engineering degrees are of 4 years duration (BEng/BE/BAI), although there are some 5-year degree courses that build on a Diploma after 3 years.

A total number of 113 answers were received from 26 countries. It results from these answers that in 21 out of the 25 countries, civil engineering education belongs to the continental system (in AT, BE, BG, CZ, DE, DK, ES, FI, FR, GR, HR, HU, IT, NL, NO, PL, PT, RO, SE, SI, SK) and in 5 countries to the anglo-saxon system (EE, IE, LT, LV, UK). However, in countries like Poland and Slovenia, the two systems coexist. As for Germany, there are, since 1998, possibilities for both Technical Universities and Universities of Applied Sciences (Fachhochschulen) to develop both kinds of programmes (leading to Dipl-Ing TU or Dipl-Ing FH or to BS and MS degrees) but none of the received answers put into evidence such a move.

Within the countries belonging to the continental system there are also differences. Thus, in most countries (AT, BE, DE, DK, ES, FI, GR, NL, NO, PT, SE a. o.) the two programmes are offered by distinct institutions, while in some countries (for instance CZ, RO) they are offered by the same institution.
The figure II.1 shows the distribution of the two systems in the 25 countries involved in the survey.

From the 81 answers belonging to the continental system, 58 refer to the long duration programmes (56 of 5 years and 2 of 6 years) and 23 to the short duration programmes (16 of 4 years, 3 of 3.5 years and 4 of 3 years).

From the 32 answers belonging to the anglo-saxon system, 7 refer to programmes of 3 years, 24 to programmes of 4 years and 1 to a programme of 5 years. Suplementary information regarding the legal duration of studies can be found in the Annex II.

It was important to compare the legal (formal, nominal) duration of studies to the actual one. The percentage of the overrun period, as a mean value of received answers for different programmes, varies between 5% and almost 40%, but for some countries the common overrun period is quite higher (Italy, for instance, has a 45% overrun period). The figure II.2 gives some examples of the overrun period, in percentages, for the five-year programme.

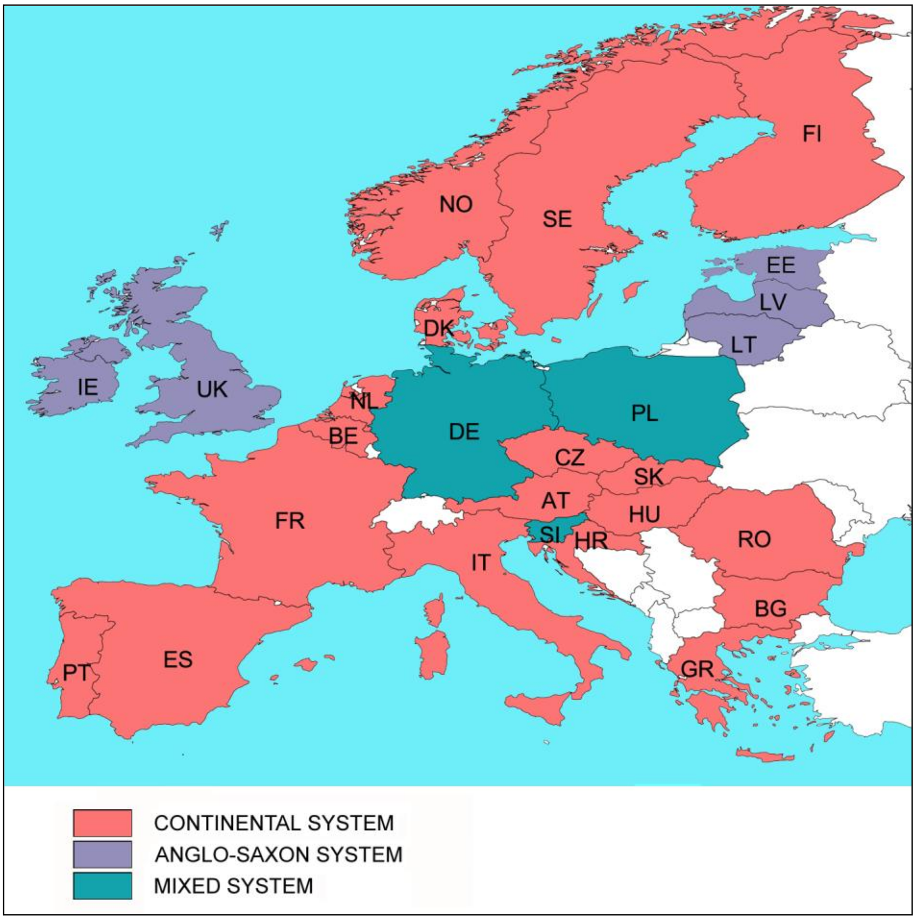


Figure II.1 Distribution of civil engineering education systems across European countries represented in the EUCEET consortium of partners

2. Qualification title

Respondents were asked to give the qualification title corresponding to the programme delivered. The table II.2 in the Annex II summarises the qualification titles, in English and in the native language.

3. Official academic calendar

In the framework of this study, the official academic calendar is considered annual if there is a single exams session at the end of the year, or divided into semesters, terms or modules for more corresponding exams sessions.

Almost 75% (82) out of a total of 113 available answers indicate a two-semester type of academic calendar, with a quite symmetric distribution of the teaching weeks (see figure II.3). Particular features of this system, for universities in Germany, Greece, Spain etc., can be noticed by consulting the EUCEET database.

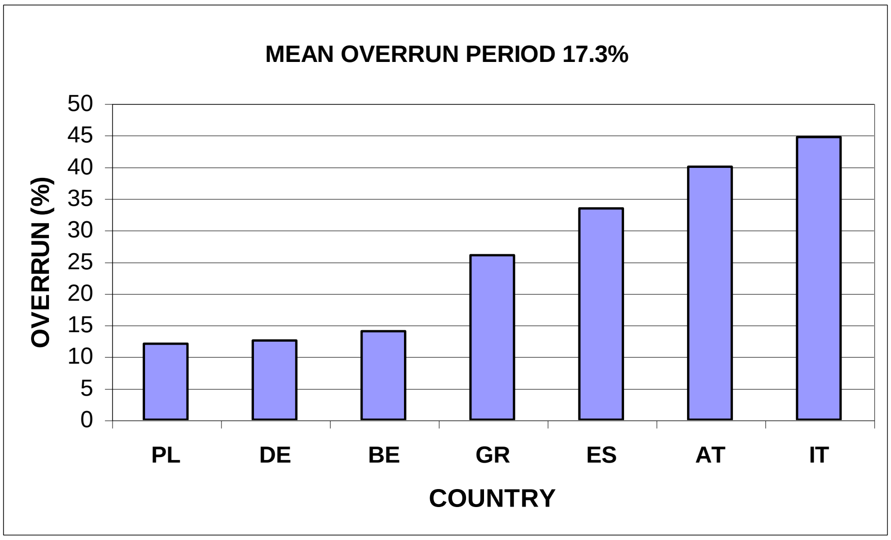


Figure II.2 Differences between official and actual duration of studies (5-year programme)

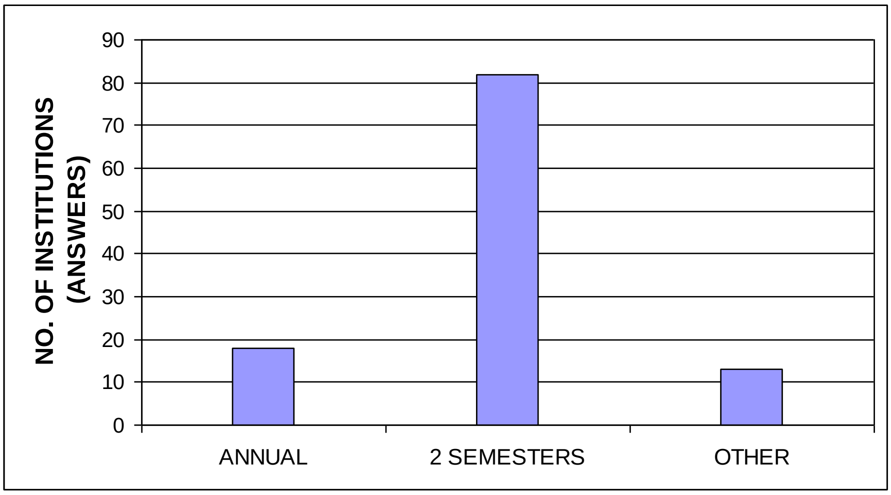


Figure II.3 Official academic calendar versus number of received answers

More than 10% of the answers (13) reveal another academic calendar or a miscellaneous type of programme. The institutions from United Kingdom, although having a term divided academic year, choose the annual calendar because of a single exams session.

Regarding the total number of weeks spent by students in the teaching and examination periods every year, the mean values of the received answers are the following:

- 28.5 teaching weeks/year;
- 5.1 weeks/year for exams preparation and
- 6.6 weeks/year for exams.

The corresponding minimum and maximum values are shown in the figure II.4.

Some peculiarities are occurring in the final semester (year), which has a different programme related to the diploma project preparation, like for instance at the University of Liège, where the 5th year is divided in modules.

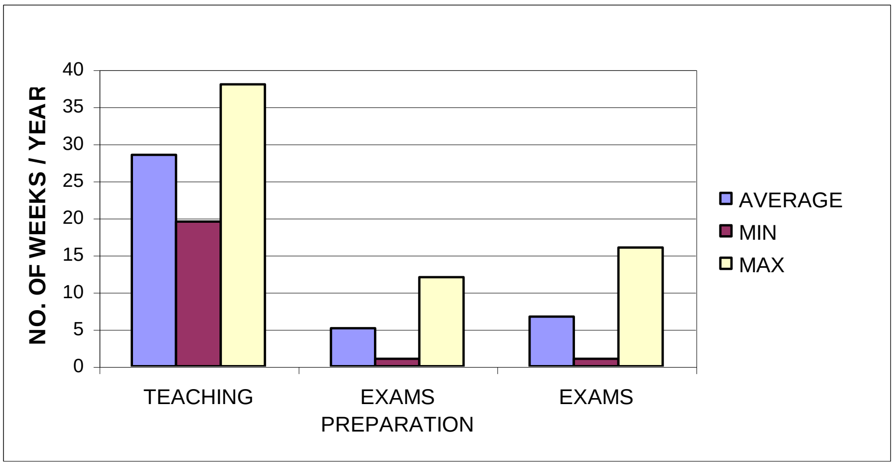


Figure II.4 Teaching and exams periods per academic year

4. Entry requirements and selection criteria

The access to engineering education across Europe is of two kinds: an open entry (called “not restricted” in the questionnaire), where anyone who passes (graduates) the assessment at the end of the secondary school is entitled to enter university, or a system of competitive entry based on several criteria (called “restricted” in the questionnaire).

For almost 90% of the institutions which completed the questionnaire, the entry to engineering education is restricted. This percentage is quite similar with the one regarding the institutions with a limited number of entry places, although there is no perfect match between the two categories.

The criteria for entry selection, as they were defined by the members of Working Group A in the questionnaire, are the following:

1. School results
2. State examination
3. University examination
4. Interview
5. Others

According to the received answers, almost 45% of the institutions have a single-criterion assessment of candidates (as it is shown in figure II.5), almost uniformly distributed between school results, state examination and university examination. Two answers reveal a different type of assessment (not explicitly included in the questionnaire).

From a total of 98 answers received to this question, a multi-criteria selection is adopted by 46 institutions, from which 38 use two combined criteria, 7 use three combined criteria and 1 the four above mentioned criteria.

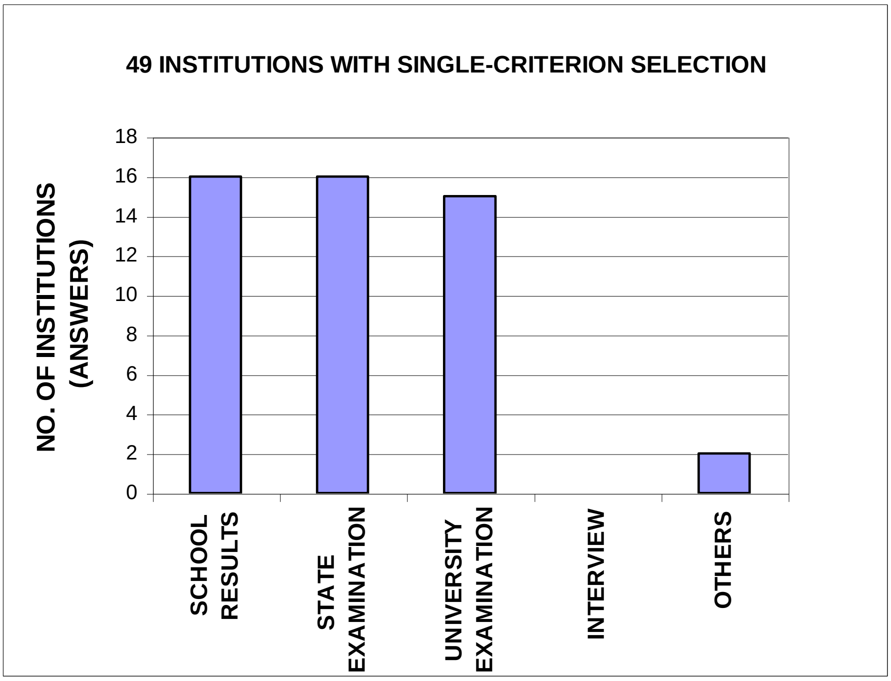
For the selected institutions with restricted entry, the average success rate is 49.5%, but with a wide, scattered distribution between 5% and 100% (figure II.6). Although the answers with low values (less than 3%, especially from France) were removed, the minimum success rate is characterising France, United Kingdom and Bulgaria. It would be interesting to know if these low rates are related to the local interest for civil engineering. A 100% success rate found in a few answers (Germany, Ireland, Norway and Slovenia) is proving either a misunderstanding of the question or a formal assessment by school results (without competition).

The figure II.7 presents the distribution of success rate at entry in several countries, as an average of rates within the received answers.

Regarding the beginning of specialised civil engineering education, only 30% of the answers are mentioning a common entry to all engineering courses. For most of these (19 answers), the selection stage for civil engineering is after completing the second year of studies. Out of 113 answers, 75 institutions are providing specialised civil engineering education beginning with the first year. The selection stage for the others is presented in figure II.8.

The institutions with limited number of places (implying a competition at entry) represent 78% of the total number of received answers.

Information about the inflow number of students enrolling in Civil Engineering in various institutions across Europe in the last few years can be obtained by consulting the EUCEET database.



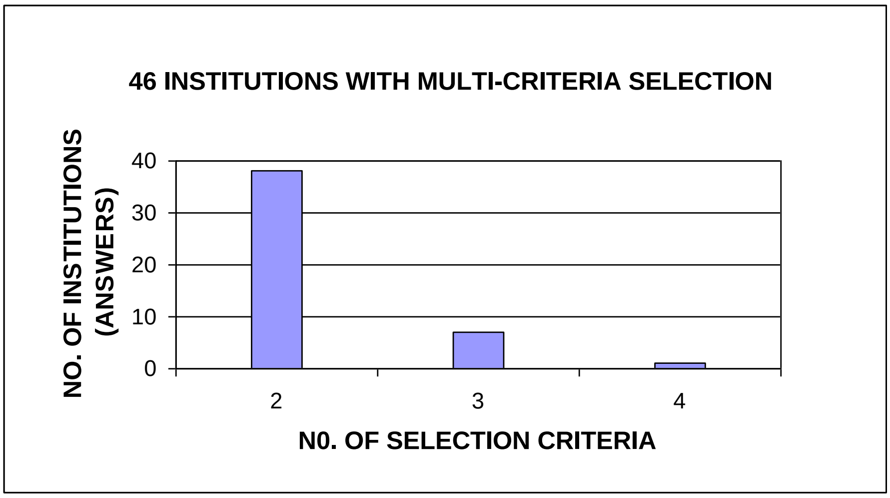


Figure II.5 Type and number of selection criteria at entry

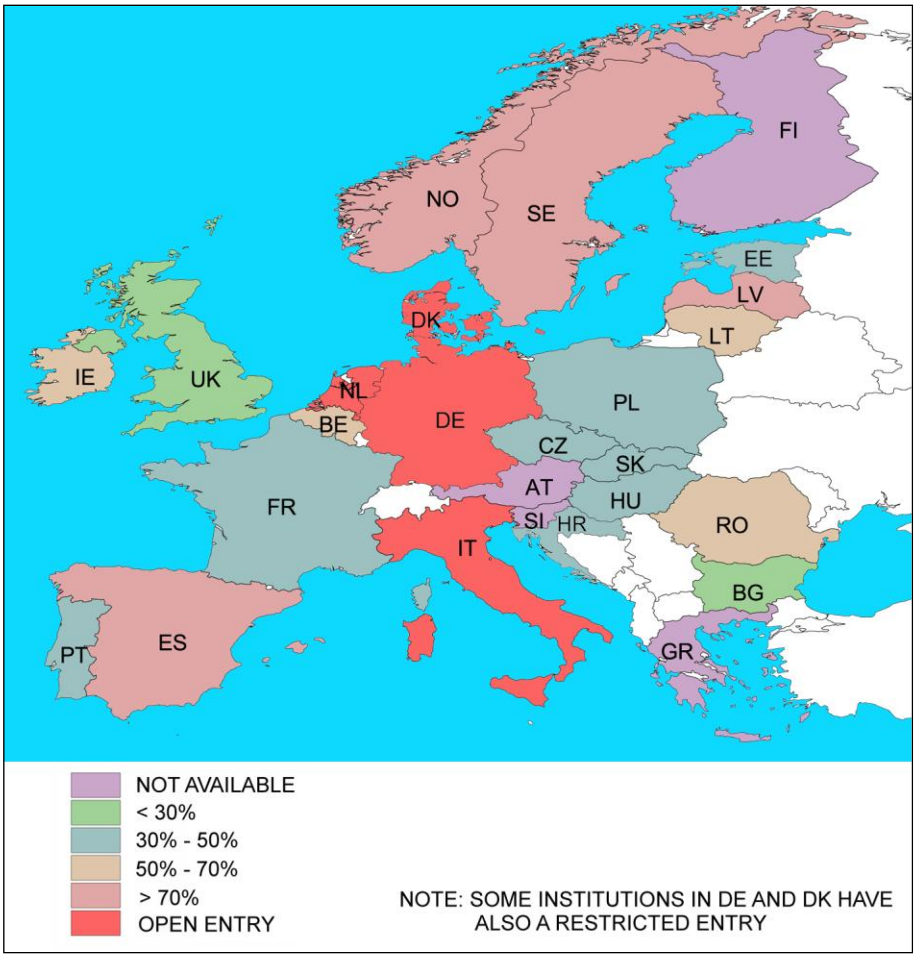


Figure II.6 Percentage of success rate at entry

The typical age of students at entry varies due to the length of secondary school and, in some countries, because of the military service requirements for males. Although the calculated mean value for all received answers is 19 years, the typical age at entry is scattered between 18 and 23 years. As it is shown in figure II.9, 45% of the answers are indicating 18 years as the typical age at entry.

Analysing the gender balance by the received answers, the average values of female students is 22%, comprised between a minimum of 3% and a maximum of 48%. The distribution of female students rate versus the number (%) of corresponding answers in shown in figure II.10. Anyway, civil engineering does not seem to be a very attractive option for the female potential students.

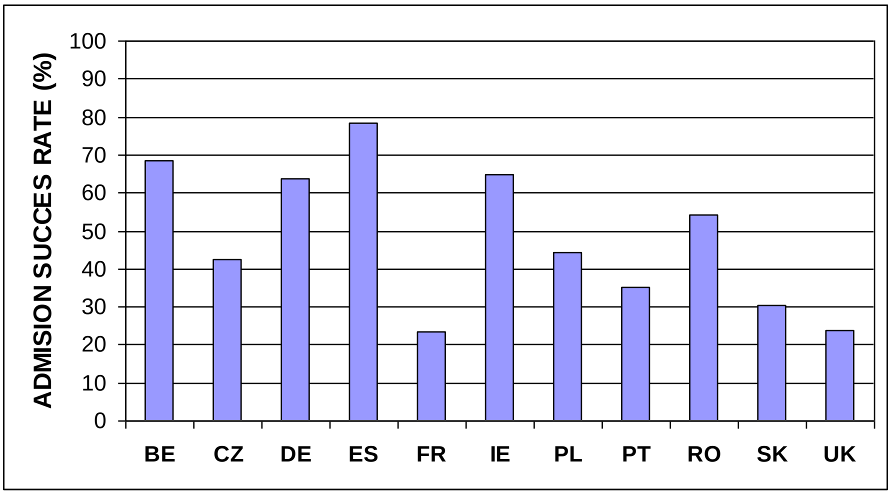


Figure II.7 Average percentage of success rate at entry in several countries

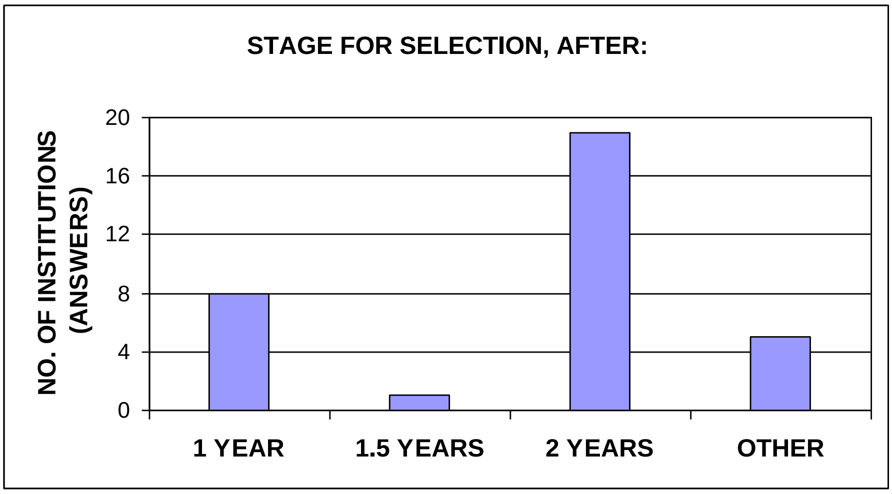


Figure II.8 Selection stage for civil engineering courses

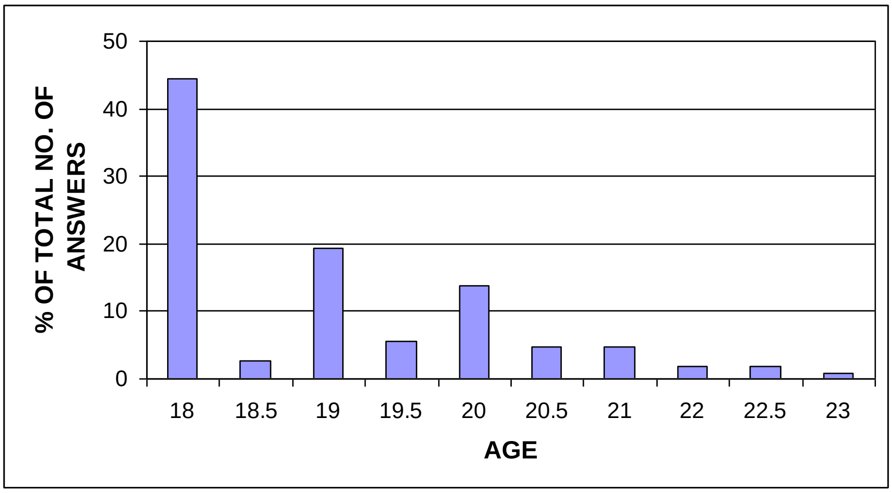


Figure II.9 Typical age of students at entry

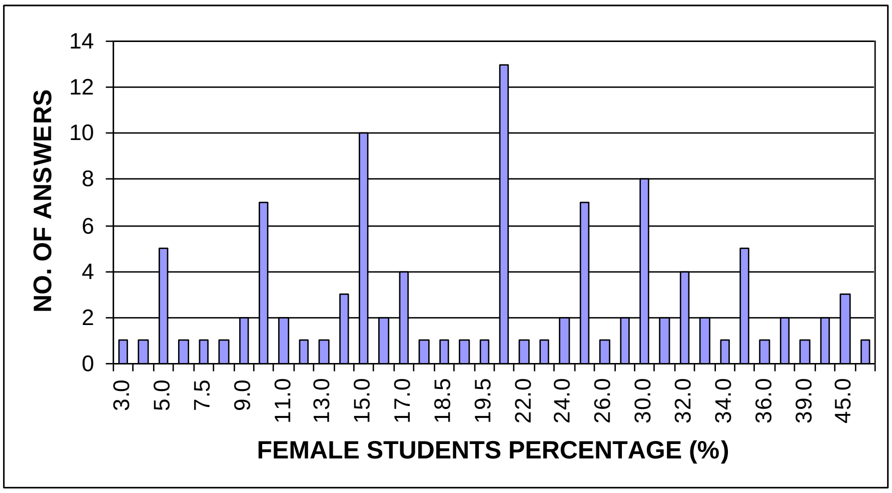


Figure II.10 Percentage of female students enrolled in civil engineering education

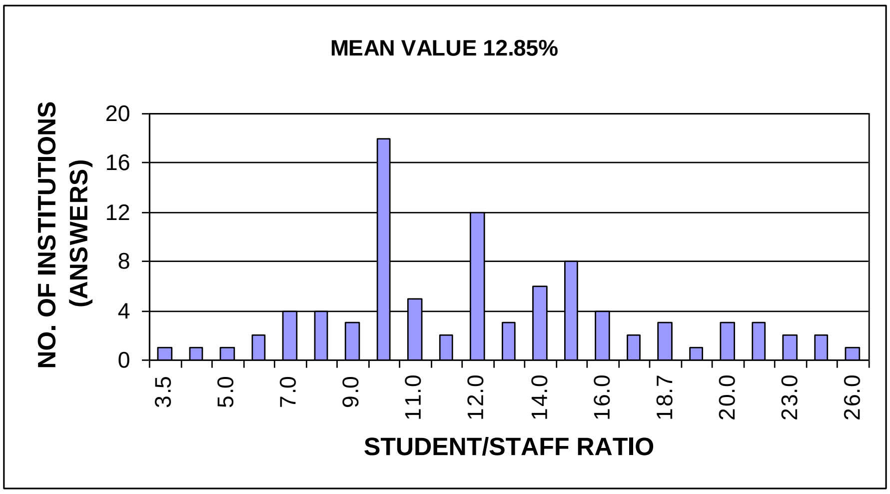


Figure II.11 Student/staff ratio versus the number of received answers

An interesting feature characterising the organisation of studies is the ratio between the total number of students enrolled in the university and the total number of the teaching staff members. Figure II.11 shows the prevailing values of this ratio (10 for almost 20% of answers and 12 for another 12.5%). Unfortunately these figures are also very scattered, with extremes that are difficult to explain (less than 5 in institutions from Germany and France, or over 20 in institutions from Germany, Greece and Ireland). Generally, the higher values are corresponding to short programme institutions, like the Universities for Applied Sciences.

5. Progression of students, overrun and dropout rate

A general assessment of these matters is difficult because of the differences between education systems, tradition and size of institutions across various countries.

In respect to the progress of students, the EUCEET questionnaire proposed one or more choices from 4 different systems:

- fully completing the obligations specified in the curriculum;
- obtaining a minimum number of credits;
- jury decision;
- others.

The distribution of these criteria versus the percentage of the total received answers is shown in figure II.12. Because of the difficulty of graphical representation for all combined criteria (for answers with more than one option), these data were represented together with the "other" option. The first criterion, regarding the requirement to fully complete the obligations in the curriculum, is present almost in all combined answers. Consequently, it can be stated that the first criterion is the most important, covering more than 80% of answers.

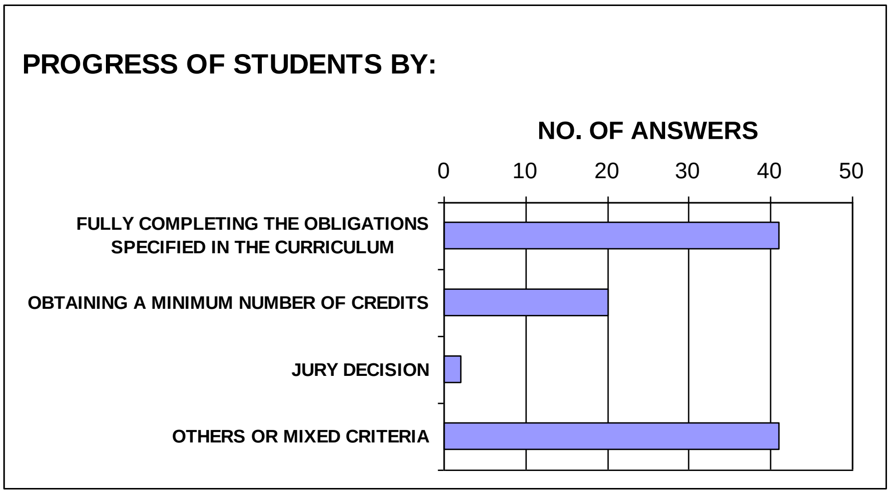


Figure II.12 Progress criteria versus received answers

To analyse the success rate of the student to progress from one academic year to the other, the answers were divided in the main categories (by legal duration). The mean success rate and the extreme values recorded from the received answers are presented independently in figures II.13 and II.14 for the 5 and 4 years programmes. While for the long duration programme the success rate is increasing along with the progress of students (from an average of 40% in the first year to almost 80% in the last), the data concerning the 4 years programme are showing a constant rate of success (between 55% and 60%). To emphasise the differences in the rate of success across Europe, some figures in Annex II are presenting these distributions for several selected countries.

The total number of students enrolled in various universities underlines the huge difference between universities' size. Although the extreme values were eliminated, the charts in figures II.15 and II.16 are conclusive. To avoid major differences between long and short programmes, only the figures corresponding to the third year were selected. For the 5 years programme, the total number of students enrolled is between a dozen and more than 600, while for the 4 year programme this number is between 12 and 300.

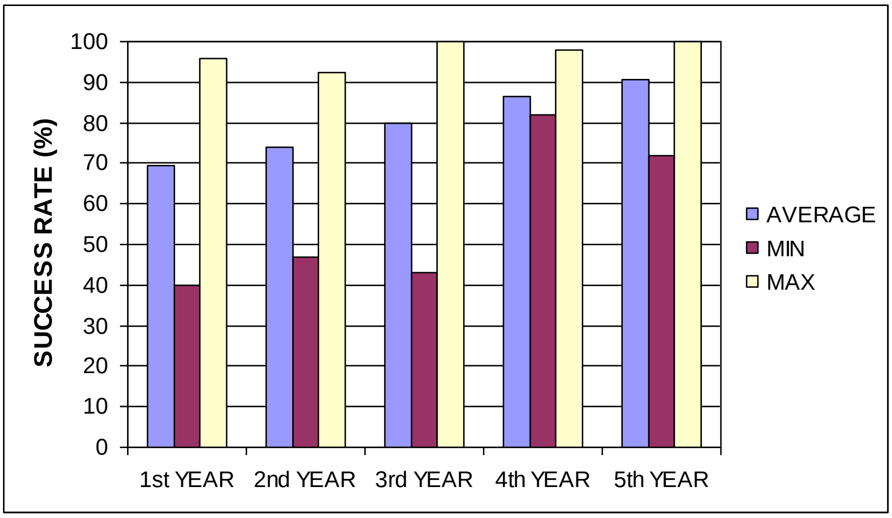


Figure II.13 Average success rate (5-year programme)

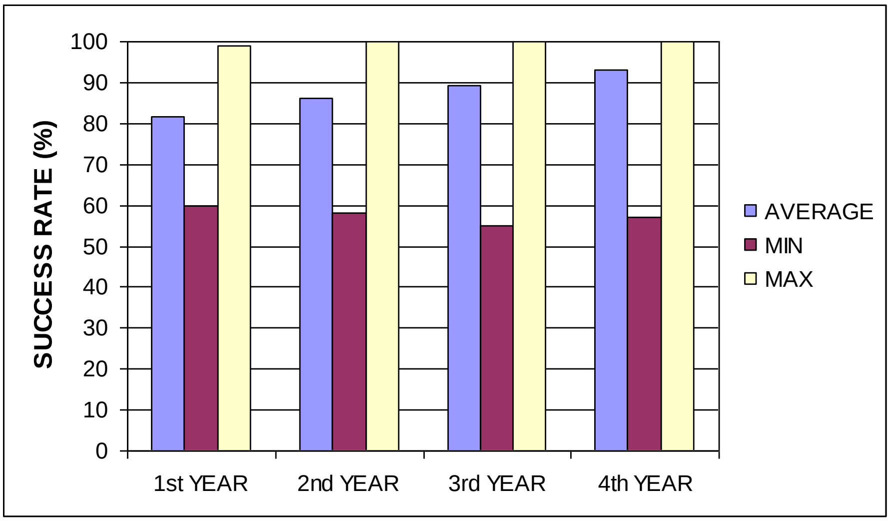


Figure II.14 Average success rate (4-year programme)

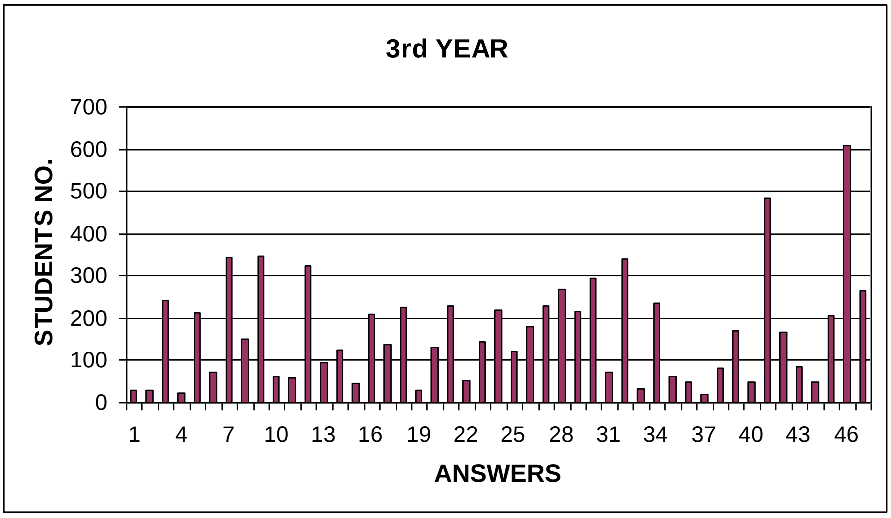


Figure II.15 Number of enrolled students in various institutions (5-year programme)

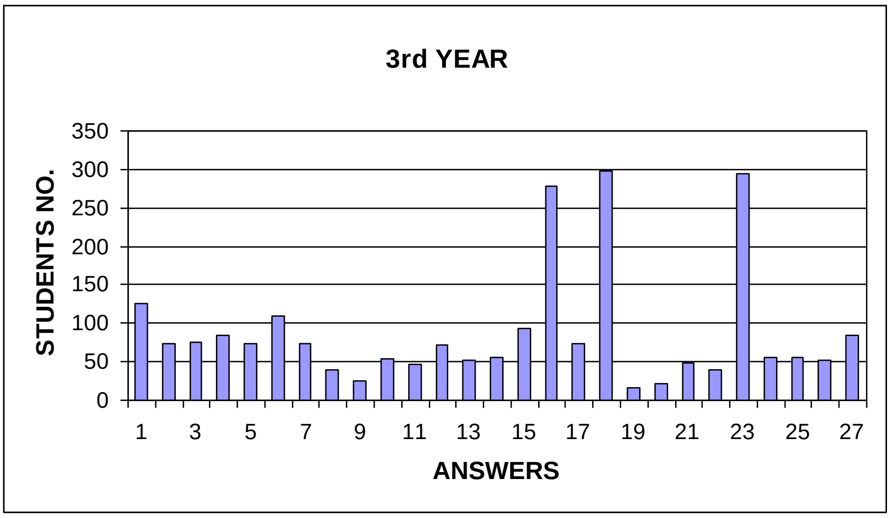


Figure II.16 Number of enrolled students in various institutions (4-year programme)

A picture of the total number of foreign students enrolled in civil engineering education in various countries (per number of answers) is shown in figure II.17.

The success rate of students at progress from an academic year to another is also reflected by the information regarding the percentage of students completing their studies in the official duration or in a longer period. The average of all answers as well as the extreme values are represented in figure II.18. Some relevant examples of the mean values per country are shown in figure II.19. One can notice that a very small number of students are completing their studies in the official length in countries as Italy, Greece, Finland or Spain, while for other countries the answers are showing a complete different picture: in the Czech Republic, France, Ireland or United Kingdom the percentage is over 80%.

Another index characterising the civil engineering education is the dropout rate. A chart with the percentage of students leaving the department before completing their studies in several countries is presented in figure II.20. While the average percentage is of 15%, the lowest value corresponds to Belgium (3%) and the highest value to Slovenia (with over 60% dropouts).

The dropout rate must be also connected to a limited permitted duration of studies. From the total number of received answers, 45% of institutions have a limited duration of studies. The maximum permitted duration is, as shown in figure II.21, between 7 or 10 years in most cases, reaching 14 years in one case (Imperial College - London).

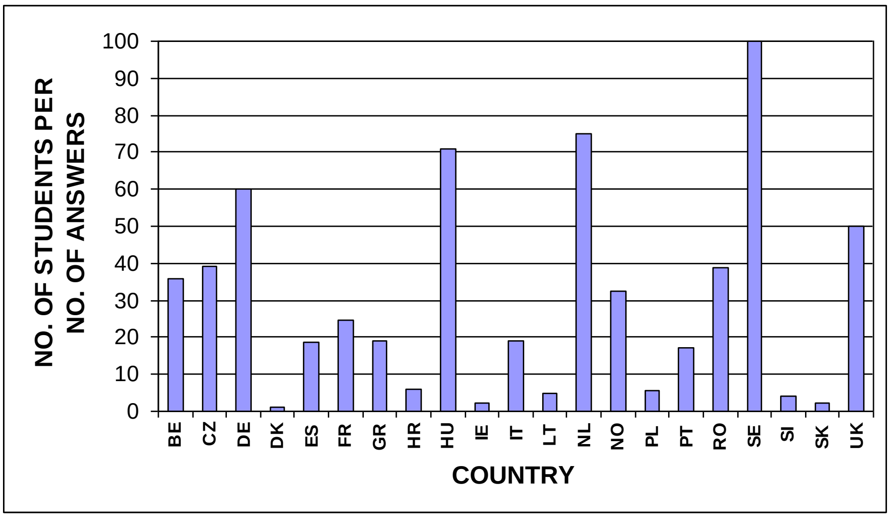


Figure II.17 Average number of foreign students enrolled in civil engineering studies

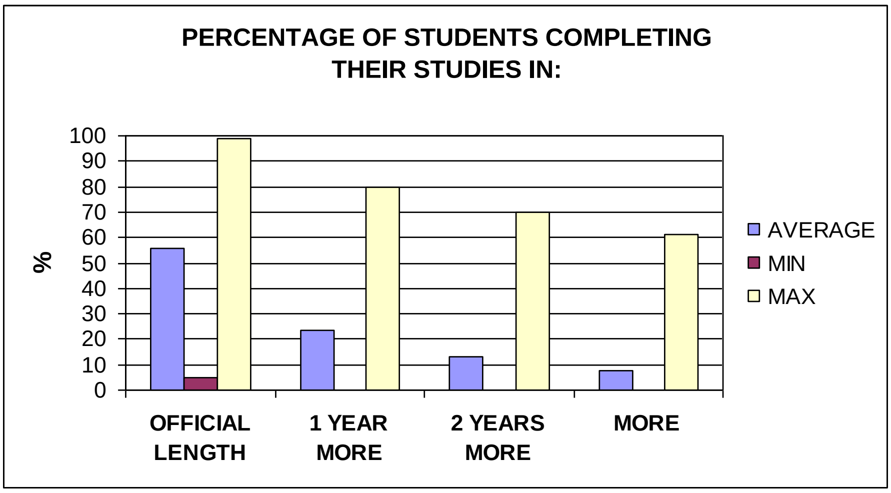


Figure II.18 Outflow of students

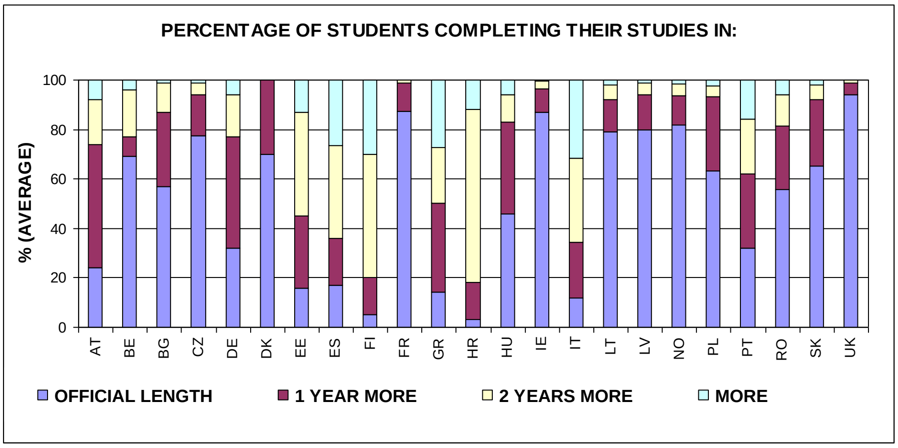


Figure II.19 Average values for the outflow of students in various countries

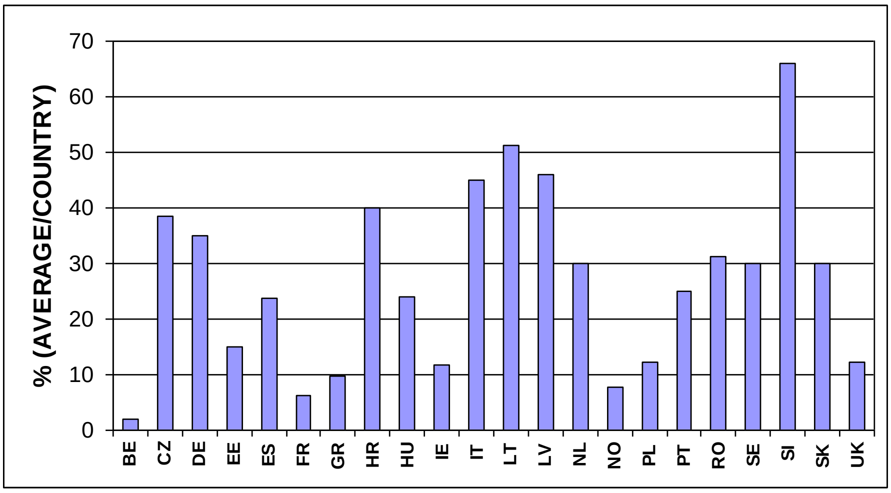


Figure II.20 Percentage of students leaving the institution before completing their studies

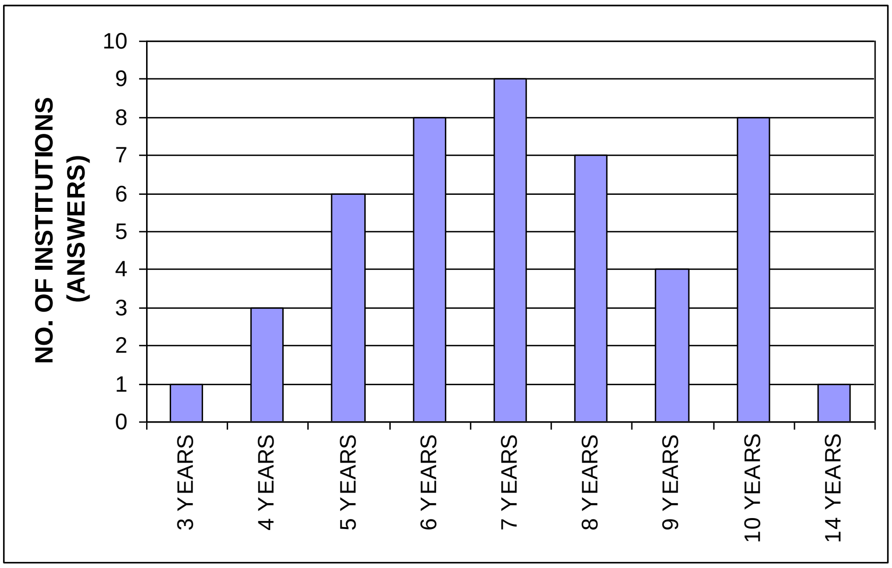


Figure II.21 Maximum permitted duration of studies

6. Examinations, repeat exams

The main information the questionnaire is referring to is about the existence of the second chance to repeat an exam during the same academic year and, also, if this chance is limited or not. According to the received answers, in most institutions students are allowed to repeat exams in the same academic year, but the repeat chance is not unlimited (see figure II.22).

On the other hand, the respondents had to choose between some possible situations, if a student from their institution fails an examination:

- he/she is allowed to proceed if the overall mark is satisfactory;
- he/she may repeat the exam for this course unit;
- he/she is obliged to repeat the whole semester/year;
- he/she has no right to continue the studies;
- others.

An affirmative response for the first choice was obtained from only 35 institutions out of 108 available answers. No obvious connection could be made between the credit allocation system and the possibility to proceed if the overall mark (number of accumulated credits) is satisfactory. In the mean time, some universities (as those in Germany) have a random order for disciplines, according to the students' options. By contrary, in 85 institutions the student may repeat the exam for the failed course unit, in different circumstances, as it is shown in figure II.23. In very few answers (11) the student is obliged to repeat the whole semester/year or has no right to continue the studies (8 answers).

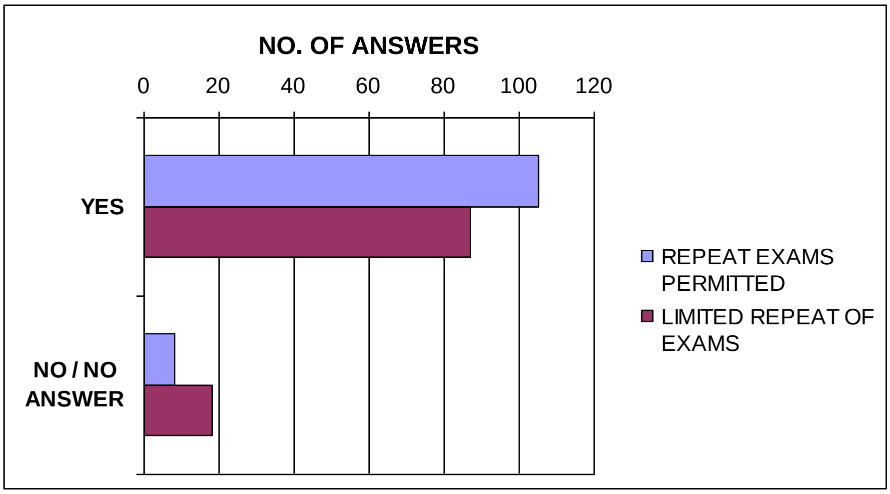


Figure II.22 Chance of repeating the examinations

Regarding the number of chances for a student to repeat an exam/semester/year, the answers are scattered between one time to no limit for an exam and one or two times for an academic year (according with the maximum permitted duration of studies).

More detailed information about examinations/repeat matter can be obtained by consulting the answers in the EUCEET database.

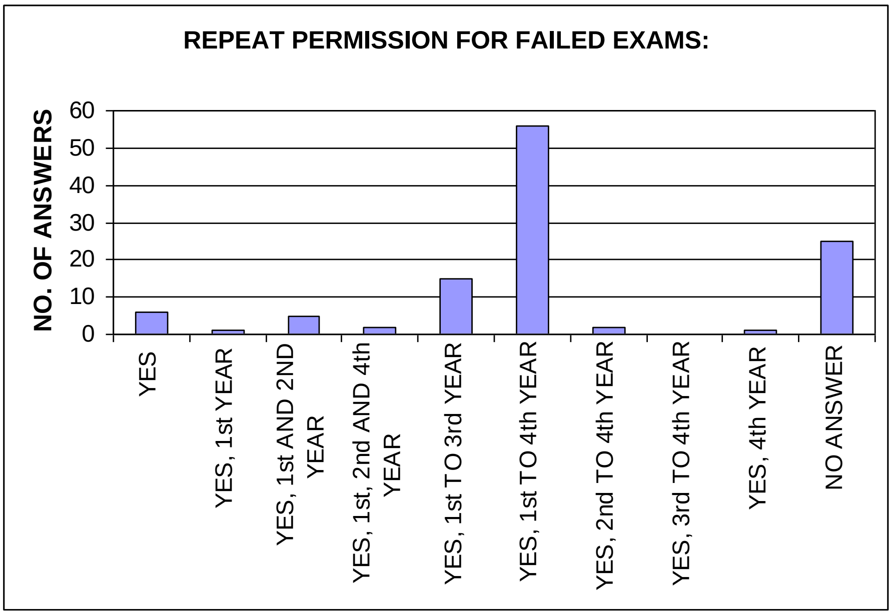


Figure II.23 Continuing studies by repeating exams

7. Final assessment and credits allocation

The EUCEET questionnaire proposed five possible choices or combinations for the final assessment criteria:

- Criterion 1 – fulfilling of all requirements in the curriculum
- Criterion 2 – accumulation of a number of credits
- Criterion 3 – final examination
- Criterion 4 – diploma project
- Criterion 5 – others (not explicitly mentioned)

According to the completed questionnaires, out of 94 answers, 28 reveal a single-criterion assessment in order to obtain the graduation (qualification), while most of the answers (71) reveal several combinations of the above criteria. The corresponding distributions are presented in figures II.24 and II.25.

Regarding the students' evaluation along their studies, most of the respondent institutions (74) have a credits allocation system, from which 65% are using ECTS and 35% local or equivalent system of credits.

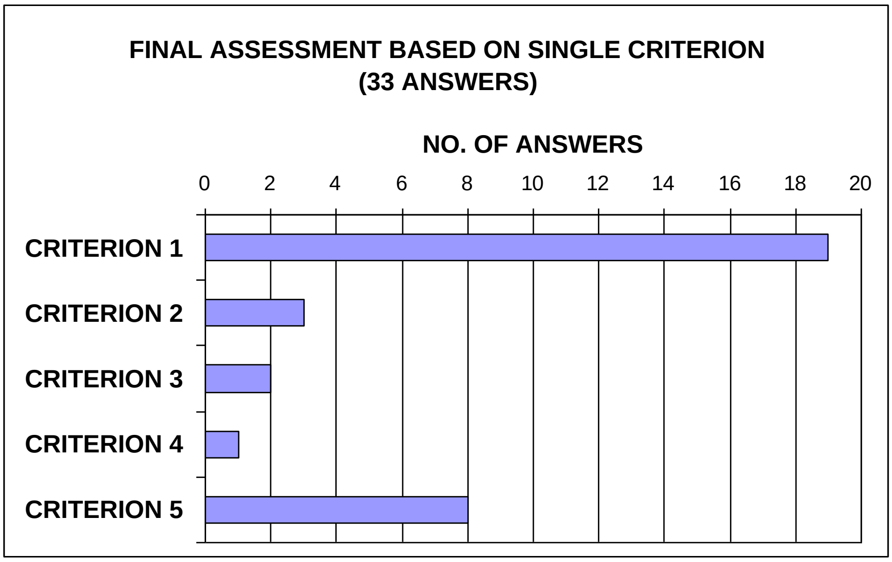


Figure II.24 Single-criterion final assessment

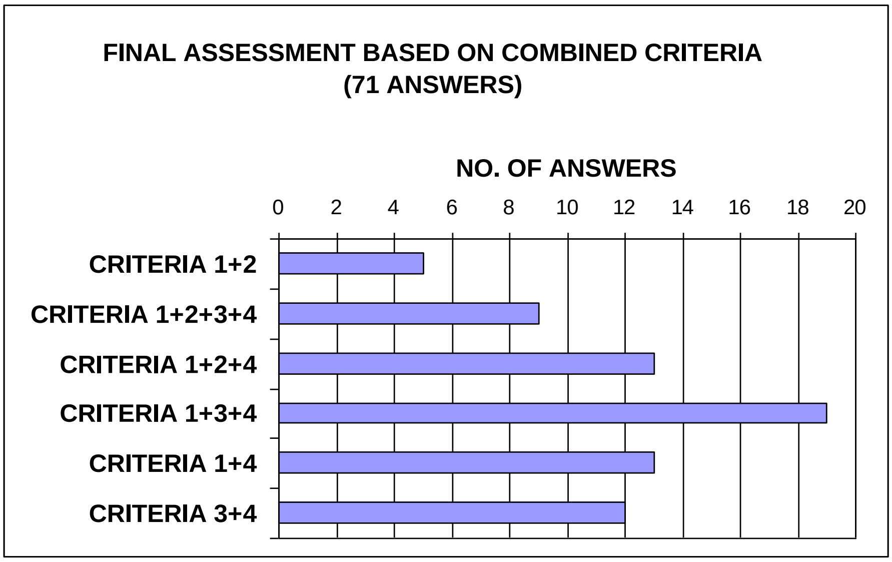


Figure II.25 Multi-criteria final assessment

8. Education in other languages and exchange of students

The languages of instruction available in all institutions are the official languages of every country, even more than one, if the case. From the EUCEET questionnaire's point of view, only instruction languages different than the official ones are considered as "education in other language".

Out of 104 answers to this question, 33 institutions are providing courses (some disciplines) in other languages and 26 institutions are providing degree courses (complete programmes) in other languages. Most of the answers are specifying English as the first available language, followed by French, German etc.

Unfortunately, the wide extended (promoted) process of students' exchanges is not properly revealed in this survey. The question regarding the exchange of students was introduced later, as a supplementary one within the second questionnaire. Only 31 answers were received from institutions involved in such European programmes. Out of this number of institutions, 90% have agreements for mutual studies recognition.

9. General remarks and conclusions

The results of the EUCEET survey on the organisation of undergraduate studies in civil engineering was fairly good: out of 113 received answers, 58 are from partner institutions and 55 from others. Although the majority of answers were complete or almost complete, some of them did not provide all the expected information. One can notice important differences between education systems across countries and even between institutions in the same country.

The most difficult questions to answer were those referring to specific figures as inflow of students, total number of registered students per year, distribution per age of the graduates, credits allocation. The most difficult questions to process were those referring to examination, repeat conditions and final assessment.

Despite the obvious limitations, due to the limited content of the questionnaire, as well as to the quite scattered information, some clear trends can be drawn out concerning the main types of programmes, academic calendar, entry requirements and progress of students, dropout rates and final assessment systems. Informations on typical age of students and gender balance are also available.

Table II.1 Organisation of studies - cumulative table of the recived answers

CRT.NO.	COUNTRY	QUESTION	0.3		0.4						
		CITY			0.4.1			0.4.2			
			a	b	a	b	c	a	b	c	d
1	**AT**	VIENNA	5	7		X		S	30		6
2	**BE**	LEUVEN	5	5.3	X			Y	28	8	6
3		LIEGE	5	5.8		X	X(5Y)	S/M(5Y)	26/(15)	4	8
4		LOUVAIN	5	6		X		S	28	4	5
5	**BG**	SOFIA	5			X		S	30		8
6	**CZ**	BRNO	5	6		X		S	28		10
7		PARDUBITZE	5			X		S	28		12
8		PRAGUE	5.5	6		X		S	28		10
9	**DE**	BERLIN (AS)	4	4.5		X		S	35		6
10		BERLIN (TU)	4.5	7.5		X		S	30	8	16
11		BIBERACH	4.5	5		X		S	30	4	4
12		DRESDEN	5	5.5		X		S	30		8
13		ECKERNFORDE	4	5			X	S	34		10
14		ERFURT	4	5		X		S	32		4
15		FRANKFURT	4	6		X		S	32		4
16		HAMBURG	5	5.5		X		S	30	9	8
17		KAISERSLAUTERN	4.5	6.5		X		S	27	12	12
18		KOLN	3.5			X		S	30		6
19		LEIPZIG	5	6		X		S	28	8	8
20		LUBECK	4	4		X		S	30	12	2
21		MUNCHEN	5	5.5			X	S	31	12	4
22		NEUBRANDENBURG	4	4.5		X		S	30		8
23		OLDENBURG	4	4.2		X		S	34		2
24		RATISBON	4	4.5		X		S	38		8
25		WUPPERTAL	4	5		X					
26	**DK**	LYNGBY	5	6		X		S	34	2	4
27		ODENSE	4			X		S	32		8
28	**EE**	TALLIN	4	5		X		S	32		6
29	**ES**	BARCELONA	5	7	X			S	30	12	9
30		MADRID	6	8.2	X	X		S	30		
31		SANTANDER	6	8		X		S	30		6
32		VALENCIA (1*)	5	7		X		S	28		7
33		VALENCIA (2*)	5	6		X		S	28		7
34		VALENCIA (3*)	3	4		X		S	28		7
35	**FI**	HELSINKI	5	7		X		S	29		6
36	**FR**	BORDEAUX	4			X		S	24	2	4
37		CACHAN	4			X		S	32		2
38		LILLE	2	2			X	Y	24		
39		LYON (ENTPE)	3(5)	3(5)			X	S	33		
40		LYON (INSA)	5	5.1			X	S	34		
41		NIMES	3				X	Y	24	0	0
42		PARIS (ENPC)	3(5)				X	T	20		
43		PARIS (ESTPE)	5	5			X	Y	32		
44		REIMS	5	5			X				
45		SAINT-ETIENNE	5	5			X	Y	32	0	0
46		TOULOUSE	3		X		X	Y	32		6
47	**GR**	ATHENS	5	6.5		X		S	26	2	6
48		PATRAS	5	7		X		S	26	2	6
49		PIREAS	3.5	5		X		S	30		4
50		SERES	3.5	4.5		X		S	30	2	8
51		THESSALONIKI (1**)	5	6.5		X		S	26		4
52		THESSALONIKI (2**)	3.5	5		X		S	30		8
53		VOLOS	5	NA		X		S	28		6
54		XANTHI	5	6		X		S	26		6
55	**HR**	ZAGREB	4.5	7		X		S	30		12
56	**HU**	BUDAPEST	5	5.5		X		S	30		12

* Valencia: (1) Civil Engineering; (3) Environmental Engineering; (3) Technical

** Thessaloniki: (1) Aristotle University; (2) T.E.I.

Table II.1(continued)

CRT.NO.	COUNTRY	QUESTION	0.3		0.4						
		CITY			0.4.1			0.4.2			
			a	b	a	b	c	a	b	c	d
57	IE	CORK	4	4	X			T	25	5	4
58		DUBLIN (TC)	4	4			X	S/T	22-24	1 to 11	3
59		DUBLIN (UC)	4	4	X			T	24	2	4
60		GALWAY	4	4		X		S	24	3	4
61		SLIGO	5	5		X		S	30	2	4
62		WATERFORD	4	4	X			Y	30	2	2.5
63	IT	FLORENCE	5	7.5		X		S	26		13.0
64		MILANO	5	7.5		X		S	26		14
65		TORINO	5	6.7		X		S	24	10	10
66	LT	KAUNAS (UA)	4			X		S	32		8
67		KAUNAS (UT)	4			X		S	32		8
68		VILNIUS	4	4		X		S	32		8
69	LV	RIGA	3	3		X		S	32		6
70	NL	DELFT	5	6				B	6	2	2
71	NO	GIOEVILE	3			X		S	32		6
72		NARVIK	3	3		X		S	29	4	5
73		PORSGRUNN	3	3.5		X		S	26	2	12
74		STAUANGER	3	3.5		X		S	26		12
75		TRONDHEIM (C)	3	3		X		S	28		4
76		TRONDHEIM (US)	4.5	5		X		S	27		9
77	PL	BIALYSTOK	5	5.5		X		S	30		8
78		GDANSK	4	4.5		X		S	30		6
79		GLIWICE	4	4.5		X		S	30		10
80		KIELCE	5	5		X		S	30		7
81		KRAKOW	5	5.5		X		S	30	9	9
82		WARSAW	4(5)	5(6)		X		S	30		4
83		WROCLAW	5	6		X		S	30	4	4
84	PT	COIMBRA	5			X		S	30		3.5
85		COVILHA	5	6		X		S	30	4	4
86		LISBON	5	6.6		X		S	30		10
87	RO	BUCHAREST (1*)	5	5.5		X		S	28	8	
88		BUCHAREST (2*)	5	5.5		X		S	28	8	
89		BUCHAREST (3*)	5	5.5		X		S	28	8	
90		BUCHAREST (4*)	3	3.5		X		S	28		10
91		CLUJ-NAPOCA (1**)	5	5.5		X		S	28	8	
92		CLUJ-NAPOCA (2**)	5	5.5		X		S	28	8	
93		CLUJ-NAPOCA (3**)	3	3.5		X		S	28	8	
94		IASI	5	5.5		X		S	28	8	
95		TIMISOARA	5	6		X		S	28	8	
96	SE	GOTEBORG	4.5	5				Q	7		2
97	SI	LJUBLJANA	5	7.5		X		S	30		12
98		MARIBOR	4	7		X		S	30		
99	SK	BRATISLAVA	5			X		S	26		14
100		KOSICE	5	5.6		X		S	28		13
101		ZILINA	5	5		X		S	24		14
102	UK	BATH	4	4	X			S	24	2	4
103		BRISTOL	4		X			T	24	1	2
104		CAMBRIGE	4	4	X			T	19.5	1	1
105		DURHAM	4	4	X			T	22	1	3
106		EDINBURGH	4	4	X			T	25	2	3
107		GLASGOW	5(4)	5(4)	X			S	23	3	4
108		LONDON (CU)	4(3)	4(3)	X			T	30	4	4
109		LONDON (IC)	4		X			T	27.5	1	2.5
110		MANCHESTER	4(3)	4(3)	X			S	24	2	4
111		NOTTINGHAM	4(3)	4(3)	X			S	20	4	4
112		PORTSMOUTH	3	3	X			S	24	4	2

* Bucharest: (1) Civil and Industrial Buildings; (2) Hydrotechnics; (3) Environmental Engineering; (4) Technical

** Cluj-Napoca: (1) Civil Egineering; (2) Railroads and Bridges; (3) Technical

Table II.1 (continued)

CRT.NO	0.5											
	0.5.1							0.5.2				
		0.5.1.1					0.5.1.2	0.5.2.1	0.5.2.2			
		a	b	c	d	e			a	b	c	d
1												
2	Y			X				Y			X	
3	Y			X			70	Y			X	
4	Y			X			67	Y			X	
5	Y			X			11	N				
6	Y			X			53	N				
7	Y	X		X			35	Y			X	
8	Y			X			50	N				
9	Y	X										
10	Y	X				X	95	N				
11	Y	X						N				
12	N							N				
13	Y	X				X	35	N				
14	Y					X	100	N				
15	Y	X						N				
16	N							N				
17	N											
18	Y	X					50	N				
19	N							N				
20	Y	X					50	N				
21	N							N				
22	N							N				
23	Y	X				X	25	N				
24	Y	X					90	N				
25	N							Y				X
26	Y	X						N				
27	N							N				
28	Y	X	X				49	Y		X		
29	Y	2	1				50	N				
30	Y	1	2				90	N				
31	Y		X				70	N				
32	Y	2	1				85	N				
33	Y	2	1			X	85	N				
34	Y	2	1				90	N				
35	Y		X	X			50	N				
36	Y	X		X			40	N				
37	Y		X				10	Y	X			
38	Y	X										
39	Y			X		X	1.8	Y			X	
40	Y	2	1		3	4	18	Y			X	X
41	Y			X	X		25	Y			X	
42	Y		2		3	1	1	Y	X			
43	Y			X			15	Y				X
44	Y	1			2		20	Y				X
45	Y	X				X	5	N				
46	Y			X	X		50	Y	X			
47	Y		X					N				
48	Y		X					N				
49	Y		X					N				
50	Y		X					N				
51	Y		X					N				
52	Y		X					N				
53	Y		X				25	N				
54	Y		X				17	N				
55	Y	X		X			50	Y				X
56	Y		X				35	N				

Table II.1 (continued)

CRT.NO	0.5											
	0.5.1							0.5.2				
		0.5.1.1					0.5.1.2	0.5.2.1	0.5.2.2			
		a	b	c	d	e			a	b	c	d
57	Y		X					N				
58	Y		X				64	Y			X	
59	Y		X				62	Y	X			
60	Y		X				33	N				
61	Y			X			100	N				
62	Y		X					N				
63	N							N				
64	N							N				
65	N							N				
66	Y	X					80	N				
67	Y	X		X			23	N				
68	Y	X		X			48	N				
69	Y	X		X			90	N				
70	N							N				
71	Y	X						Y			X	
72	Y	X					100	N				
73	Y	X						N				
74	Y	X						N				
75	Y	X					90	Y			X	
76	Y	X					100	N				
77	Y	X		X			30	N				
78	Y	X		X			30	Y			X	
79	Y	X		X			35	N				
80	Y	X		X			58	Y			X	
81	Y			X			36	Y			X	
82	Y			X			50	Y			X	
83	Y	X					70	Y	X			
84	Y	X	X					N				
85	Y	1	2				50	N				
86	Y					X	20	N				
87	Y			X			30	N				
88	Y			X			70	N				
89	Y			X			75	N				
90	Y			X			42	Y	Y			X
91	Y	X		X			45	Y			X	
92	Y	X		X			45	Y			X	
93	Y	X		X			68	Y	X			
94	Y			X			40	N				
95	Y			X			60	Y			X	
96	Y	1	2				90	N				
97	N							N				
98	Y	X	X				100.0	N				
99	Y			X			40	N				
100	Y	X		X			31.6	Y	X			
101	Y	X	X				20	Y		X		
102	Y		X		X		15	N				
103	Y		X		X	X	17	N				
104	Y		X		X	X		Y			X	
105	Y		X		X	X	20	Y			X	
106	Y		X			X	12	Y	X			
107	Y		X			X	10	N				
108	Y	X			X		20	N				
109	Y		X		X	X	17	N				
110	Y		X		X	X	18	N				
111	Y		X		X		18	N				
112	Y		X			X	90	N				

Table II.1 (continued)

CRT.NO	0.5				0.6					
	0.5.3	0.5.4	0.5.5	0.5.6	0.6.1					
									0.6.1.1	0.6.1.2
					a	b	c	d		
1	N	18	8	2.0		X				
2	N	20	15		X					
3	N	18.5	12	8.3	X		X			n-2/n
4	N	20.5	7.5	12.0	X					
5	Y	19	39	12.0	X					
6	Y	19	22	11.3		X			30/60	
7	Y	18	5	15.0		X			12/17	
8	Y	19	25	14.4		X			20/60	
9	Y	22	17	23.0				X		
10	N	19	30	16.0				X		
11	Y	20.5	9	22.0	X					
12	N	20	20	16.3	X					
13	Y	21	32	25.0				X		
14	N	20	20	26.0		X				
15	Y	20	17	23.0						
16	Y	19	25	9.0				X		
17	N	20	20	16.5						
18	Y	19	20	17.5				X		
19	N	20	10	20.0				X		
20		22	24	35.0	X					
21	N	22.5	16	12.6	X					
22		19.5	20	20.0						
23	Y	20	10	5.0	X					
24	Y	21	4		X					
25	N	18	30	10.0	X					
26	N	19	20					X		
27	N	20	15	10.0				X		
28	Y	18	25	16.0		X			40/160	
29	Y	18	30	12.0			X			6.5/7
30	Y	18	30	13.6				X		
31	Y	18	25	15.0		X			40/75	
32	Y	18	35	12.0	X	X				
33	Y	21	45	10.0	X	X				
34	Y	18	45	15.0	X	X				
35	Y	19	40	18.7				X		
36	Y	20	5	8.0	X					
37	Y	20	15	10.0	X					
38		22.5	9		X	X	X			
39	Y	20-21	31	2.5	X	X			33/60	
40	Y	18	30	10.0		X	X			
41	Y	23	3	10.0	X		X			
42	Y	21	10	0.3	X					
43	Y	20	16		X		X			ALL
44	Y	19	10		X		X			
45	Y	19	11	30.0	X					
46	Y	20	14	10.0			X			8.0/20.0
47	Y	18	26	15.0				X		
48	Y	18	34	22.0				X		
49	Y	18	45	16.0				X		
50	Y	18	40	30.0				X		
51	Y	18	35	14.0			X	X		
52	Y	18	48	15.0				X		
53	Y	18	28	8.0						
54	Y	18	36	4.0	X					
55	Y	18	25	20.0	X	X			7/10	
56	Y	18	22	11.0				X	30/60	

Table II.1 (continued)

CRT.NO	0.5				0.6					
	0.5.3	0.5.4	0.5.5	0.5.6	0.6.1					
									0.6.1.1	0.6.1.2
					a	b	c	d		
57	Y	18	19.5	18.7	X					
58	N	18	20	19.0	X					
59	Y	18	24	16.0	X					
60	Y	18	20	25.0	X					
61	Y	21	15	9.0	X					
62	Y	18	7		X					
63	N	19						X		
64	N	19	13	35.0				X		
65	N	19-20	5		X					
66	Y	18	35	3.5	X					
67	Y	18	35	6.0	X					
68	Y	18	20	12.0	X					
69	N	18	10	12.0	X					
70	N	18	17	18.0						
71	Y	20	5	10.0		X			14/20	
72	N	19	14	12.0		X		X		
73	Y	20		10.0		X		X		
74	Y		18.5							
75	Y	19	15	10.0		X			14/20	
76	Y	19-22	19	11.0		X			48/96	
77	Y	19.5	33	10.0	X	X				
78	Y	19.5	32	14.0	X	X			24/30	
79	Y	20	30	10.0	X	X				
80	Y	19.5	32	6.0	X					
81	Y	19	32	10.0	X					
82	Y	19	10	10.0		X			25/30	
83	Y	19	10	10.0	X					
84	Y	18	30	13.8		X			18/36,56/74,94/114,etc	
85	Y	18	28	15.0		X				
86	Y	18	25	13.4				X		
87	Y	18	11	14.0		X			40/60	
88	Y	18	20	8.0		X			40/60	
89	Y	18	35			X			40/60	
90			43	Y		X			40	
91	Y	19	20	6.7		X		X	40/60	12/14
92	Y	19	20	6.7		X		X	40/60	12/14
93	Y	19	37	6.7				X	40/60	20/22
94	Y	18	30	10.0		X			40/60	
95	Y	18.5	10	9.0	X	X			40/60	
96	Y	20	33	15.0				X		
97	Y	19	25	10.0	X		X			5/12,6/11
98	Y	18	37	22.0	X					
99	Y	18	30	11.0		X			40/60	
100	Y	18.5	35.4	11.0		X			40/60	
101	Y	18	25	11.0		X			50/60	
102	Y	18	15	10.0	X					
103	Y	18	23	12.0	X					
104	N	19	20	7.0	X					
105	Y	18	15	14.0	X					
106	N	18	15	11.5	X					
107	N	18	17	14.3	X					
108	Y	18	5	12.1	X					
109	Y	18	18	11.5	X					
110	Y	18	15	12.0	X					
111	Y	18	14	12.0	X					
112	Y	19	15	15.0	X					

Table II.1 (continued)

CRT.NO	0.6									
	0.6.2					0.6.3				
	a	b	c	d	e	a	b	c	d	e
1	83	75	74	82	72	4210	3216	6770	6335	3137
2	75	85	95	98	98					
3	53	82.5	93	85	100	276	168	29	32	30
4	73	75	71	92	96	351	281	28	19	23
5	85	88	78	78	58	256	245	243	216	
6	75	80	90	92	94	931	771	610	524	484
7	70	70	80	85	90	31	26	23	12	16
8	75	81	94	92	94	300	290	206	246	171
9	15	10	5	1		133	150	125	105	
10						163	194	210	209	191
11						76	38	89	122	
12	95	55	97	97	97	299	229	212	198	170
13						77	79	73	74	57
14						129	97	75	64	54
15	81					32				
16										
17						82	67	95	111	120
18										
19						63	71	72		
20						95	90	85	84	
21	84.7	92.4	89.9	86.3	77.2	267	300	343	310	325
22						78	68	74	40	41
23	80	80	80	80		132	125	110	110	
24	60	70	75	80	90	120	82	74	70	
25										
26										
27	65	75	85	90		70	50	40	35	
28										TOT 985
29	60	70	90	90	90	250	190	150	150	150
30	46	54	70.5	69.4	77.8	612	587	610	647	617
31	50	55	70	55	70	300	229	265	240	220
32	40	50	60	75	80	395	367	348	289	234
33				80	90				124	121
34	50	55	80			386	398	304		
35						81	92	62	43	44
36			70	80				40	16	
37	80	95	80	95		11	18	26	37	
38	81	90				33	22			
39	100	100	99.1			123	133	129		
40	80	90	96	98	100			96	105	105
41						24	24			
42	100	100	100				58	54		
43			93	95	99			325	325	325
44	85	88	100	100	100	20	17	20	20	19
45	96	87	100	100	100	30	26	46	52	49
46	73	75	97			31	50	44		
47	70	68	65	72	80	240	250	210	213	680
48	11.5	4.4	5.9	8.8		186	150	139	119	702
49						220	142	117		
50	65	65	65	65		276	163	110	428	
51	76.7	77	76.8	76.2	77.7	255	241	225	235	240
52						175	117	96	101	
53	60	65	63	70		64	33	29	29	30
54						203	141	130	132	123
55	40	60	60	80		250	150	140	125	110
56	60	68	78	82	82	298	267	228	242	376

Table II.1 (continued)

CRT.NO	0.6									
	0.6.2					0.6.3				
	a	b	c	d	e	a	b	c	d	e
57	66	74	76	98		60	67	53	57	
58	87	86	89	100		186	164	47	37	
59	94	90	98	98		275				
60	96	94	92	90		48	51	71	65	
61	65	80	90	95	95	153	70	52	20	14
62	60	90	98	98		56	32	52	43	
63						153	118	144	106	418
64						202	158	220	221	528
65	0	0	NA	0	0	0	0	NA	0	0
66	80	93	100	100		75	46	56	28	
67	84	88	95	98		145	130	93	79	
68	76	78	87	96		368	287	278	206	
69	58	70	73	76	97	188	91	87	76	80
70						270	1500			
71						25	17	23		
72	65	95	95			31	23	31		
73						18	19	17		
74										
75	80	95	100			63	45	42		
76	86	90	93	97	100	95	153	166	143	177
77	92	84	94	93		171	156	121	127	112
78	84					95	86	73	75	
79	70	58	55	57		413	329	298	331	128
80	73	78	71	78	85	239	165	180	173	119
81	65	48	43	37	76	409	261	230	158	162
82	82	80	75	87	90	364	369	267	233	209
83	57	70	55	89	95	428	321	216	171	229
84	66.6	47	52.1	66.1	75.1	222	301	294	265	130
85	55	80	83	85	98	158	100	71	43	45
86	83	67	65	77	67	237	279	341	232	270
87	75	92	75	89	98	315	224	236	138	142
88	42	63	49	97	100	101	44	32	20	29
89	45	81	78	91	100	96	61	62	39	29
90	46	13	19			111	32	13		
91	52	52	80	70	90	180	101	50	42	30
92	52	52	91	91	100	180	101	21	18	22
93	55	73	100			136	22	16		
94	60	60	75	80	95	350	220	170	100	100
95	55	65	74	93	96	201	130	81	51	40
96	80	75	70	65	60	115	85	85	85	85
97						215	121	50	43	47
98						53	25	17	15	
99	64	75	91	96	98	1035	659	485	416	426
100	74.1	86	91.3	95.2	98.8	525	245	166	140	118
101	56	85	95	98	98	275	164	84	90	89
102	90	90	95	100		34	28	21	12	
103	98	93	100	100		32	45	48	40	
104	99	99	99	98		295	265	294	252	
105			100	100				13	24	
106						42	48	55	47	
107	89	86	93	98	100	37	45	49	42	14
108	80	80	100	100		35	35	40	5	
109	90	92	100	97		87	57	56	85	
110	83	91	98	100		57	58	52	8	
111	95	100	100	100		83	111	84	34	
112	92.5	95	97.5			84	95	93	16	

Table II.1 (continued)

CRT.NO	0.6					0.7						
	0.6.4					0.7.1				0.7.2	0.7.3	
												0.7.3.1
	a	b	c	d	e	a	b	c	d			
1	722	794	1739	1170	866	24	50	18	8		N	
2											Y	10
3	8	8	3	4	3	5	27	17		2	Y	9
4	11	29	3	1	2	69	8	19	4	0	Y	8
5						57	30	12	1		Y	7
6	10	5	8	5	4	75	18	6	1	37	Y	8
7						100					Y	10
8	11	6	10	9	3	80	15	4	1	40	Y	10
9	21					60	30	10		30	N	
10	24	34	40	65	36(132Y6)	5	20	40	35	50	N	
11						8	74	18			Y	6
12	7	2	4	1	7	66	27	4	3		Y	8
13	2	3	3	1	1	13	43	39	5	21	N	
14						55	30	13	2	33	N	
15						1				50	N	
16						10	64	18	8	40	N	
17	15	12	10	16	9 (31)	0	32	33	35		N	
18										15	N	
19										50	Y	8
20	3	3	3	3		23	46	19	12	40	N	
21	42	27	37	29	14	43.1	37.2	12.1	7.6	50.4	N	
22						13	74	13			N	
23	1	5	22	15		80	15	5		15	N	
24	10	8	4	2		10	80	10		10	Y	7
25										50	N	
26						5					Y	10
27				1		70	30			25	N	
28						16	29	42	13	15	Y	8
29	2	5	5	14	25	20	30	40	10	20	N	
30			7	10	9(9Y6)	28.15	20.5	22.6	28.75	23.6	N	
31					2	16	21	20	43	30	N	
32					15	10	10	40	40	25	N	
33					9						N	
34			8			10	15	65	10	20	N	
35						5	15	50	30	35	N	
36			1	0		75	25			2	N	
37	0	0	0	8		85	10			5	Y	5
38		1								6	Y	2
39	2	11	22			100				0	Y	4
40			5	3	3	5	9	1		2-3	Y	7
41	0	0										
42		8	50								N	
43			9	22	30	95	5				Y	6
44						95	5				Y	6
45	1	0	1	5	5	94	6			10	Y	6
46						87	13			8	Y	3
47	15	19	15	18	25	23	46	12	19	9.1	N	
48	2	1				22	30	35	13	0	N	
49	12	8	4							9.6	N	
50	1					7.9	34.9	31.7	25.3	7.6	N	
51	2	1	3	4	1	10.4	35.5	19	35.1	3	N	
52	1	1	1			8.8	32.4	14.7	44.1	19	N	
53	4	3	2	3	2					NA	N	10
54		2		1	1	25					N	
55		1	2	2	1	3	15	70	12	40	N	
56	12	10	11	16	22	46	36	10	6	24	Y	10

Table II.1 (continued)

CRT.NO	0.6					0.7						
	0.6.4					0.7.1				0.7.2	0.7.3	
												0.7.3.1
	a	b	c	d	e	a	b	c	d			
57				1		85	12.9	6.5		5	N	
58	0	0	3	3	0	85	11	4			Y	6
59						94				6	N	
60						75	18	7		5	Y	6
61	1					95	5			30	N	
62		1				98			2	13	Y	
63	5	5	5	5	5						N	
64	4	2	2	0	5	14	25	18	43	45	N	
65	0	0	NA	0	0	10	20	50	20		N	
66				8		60	25	10	5	70	N	
67			1	1		90	7	3		36	N	
68	2	1	1			87	7	5	1	38	N	
69						80	14	5	1	46	N	
70	15	60				10	65	70	73	30	N	
71										10	N	
72	7	8	1			75	15	6	4	7.5	N	
73												
74											Y	2
75	1	1	4			85	10	5		5	N	
76			33	32	10	86	10	3	1	8.5	Y	8
77						93	6	1		15	N	
78		1				60	39			1	Y	5
79					1	65	25	5	5	15	N	
80		1	1			95	5			15	N	
81	1	2	3	1	4	23	77			6	N	
82						60	25	10		30	N	
83		4	3	3	3	48	31	13	5	3	Y	7
84						0	23	16	61	40	N	
85						8	38	32	22	15	Y	9
86	0	2	2	2	11	56	22	12	10	20	N	
87	12	11	13	11	9	65	20	10	5	40	Y	10
88										60	Y	10
89										70	Y	10
90						75	10	10	5	27	Y	6
91	4	2	1	3	1	52	20	18	10	13	Y	7
92	4	2			3	30	58	8	4	12	Y	7
93						71	17	12		37	Y	5
94	35	25	10	10	10	60	15	15	10	15	Y	7
95	10	6	5	4	3			11		3.4	Y	6
96	0	0	0	50	50	25	55	60	70	30	N	
97	4	3				0	15	63	22	66	N	
98	1										N	
99	1	1	0	1	1	73	24	3	0	21	Y	7
100		1			1	45.9	45.9	7.3	0.9	27	Y	9
101	0	1	0	0		77	10	8	5	42	Y	8
102	2	3	3	3		90	5	5		15	Y	7
103	4	10	7	1		98	2			15	N	
104	47	?	?	?		99				23	Y	5
105						100					Y	4
106						94	6					
107	4	8	23	17	2	90	10					
108	5	6	6	2		90	10			5	Y	6
109	35	21	17	22		97	1.5	1.5		9	Y	14
110	10	20	15	1		90	8	2		12	Y	5
111	8	42	26	0		98	2			17	Y	4(3)
112	8	22	46			94	3.5	2.5		2.5	Y	5

Table II.1 (continued)

CRT.NO	0.8										
	0.8.1		0.8.2					0.8.3			
	a	b	a	b	c	d	e	a	b	c	d
1				X (1-4)				3(1,2),4(3,5)			
2	Y	N								1	
3	Y	N	X	X	X		X			1	
4	Y	N	X(1-4)	X(1-4)				2(1-5)	2(1-5)	2(1-5)	
5	Y	N		X (1-4)			X (1-4)			2(1-5)	
6	Y	N	X(1-4)	X(1-4)				2(1,5)			
7	Y	N	X	X				2		1	
8	Y	N	X	X				2			
9	Y	N						2 (1-5)			
10	Y	N									2(1,2),1(3-5)
11	N	N		X (1-4)							
12	Y	N	X (1-4)	X (1-4)				2 (1-5)			
13	Y	N		X (1-4)				1 (1-4)			
14	Y	N		X (1-4)				3 (1-4)			
15	Y	N									
16	Y	N	X (1-4)	X (1-4)				NO LIMIT	NO LIMIT		
17	Y	N		X (1-4)				1 (1-5)			
18	Y	N		X (1-4)				3 (1-4)			
19	Y	N									
20	Y	N		X (1-4)				2 (1-4)			
21	Y	N		X (1-4)			X (1-4)				2 (2,4,5)
22	Y	N		X (1-4)				2 (1-4)			
23	Y	N	X (1-3)	X (4)				2 (1-4)			
24	N	N		X (1-4)				1 (1-4)	1 (1-4)	1 (1-4)	
25	Y	N		X (1-4)							
26	Y	N		X (1-4)				3 (1-5)			
27	Y	N		X (1-4)				3 (1-4)			
28	Y	Y		X(1-4)				1(1,4)			
29	Y	N		1 (2-4)	1 (1)			2(1), Y(2-4)		2(1),3(2-4)	
30	Y	N	NO (1-4)	X (1-4)							
31	Y	N		X (1-4)				6 (1-5)			
32	Y	N		X (1-4)							X (1-5)
33	Y	N		X (4)							X (4-5)
34	Y	N		X (1-4)							
35	Y	N		X				3			
36	Y	Y		X (3-4)		X (3)					
37	Y	N		X (1-2,4)	X (3)			1 (1-2)	1 (1-2)	1 (1-2)	
38	Y	N	2 (1-2)	1 (1-2)				1 (1-2)		1 (1-2)	
39	Y	N	X	X	X			1(1)	1(1)	1(1)	
40	Y	N	X (1-4)	X (3-4)				2(3,4),1(5)		0(1),1(2,4)	
41	N			X (1-3)				X (1-3)			
42	Y	N		YES (1-3)	NO (1-3)	NO (1-3)	YES (1-3)	1 (1-3)		1 (1-3)	
43	Y	N			X (3-4)	X (3-4)				1 (3-5)	
44	Y	N	N(1-4)					1(1-5)		1(1-5)	
45	Y	N	X (1)	X (1)	X (1)	X (1)	X (1)				X (1-5)
46	Y	N	X (1-2)	X (1-2)				2 (1-3)		1 (1-3)	
47	Y	Y		X (1-4)				UNL(1-5)			
48	Y	Y		X(1-4)				UNL(1-5)			
49	Y	Y		X(1-3)				UNL(1-4)			
50	Y	Y		X(1-3)				UNL(1-4)			
51	Y	Y		X(1-4)				UNL(1-5)			X (1-5)
52	Y	Y		X(1-3)				UNL(1-4)			X(1-4)
53	Y	Y		X(1-4)				UNL(1-5)			
54	Y	Y		x(1-4)				UNL(1-5)			
55	Y	N	X(1-4)	X(1-4)				4(1-4)			
56	Y	N		X (1-4)							X (1-5)

Table II.1 (continued)

CRT.NO	0.8										
	0.8.1		0.8.2					0.8.3			
	a	b	a	b	c	d	e	a	b	c	d
57	Y	N(1-2)			X(1-4)					1(1-2)	
58	Y	N	X (1-3)	X (1-3)						1 (1-4)	
59	Y		X(1-4)	X(1-4)					2(1-3)		
60	Y	N		X(1-4)	X(1-4)			3(1-4)		1(1-4)	
61	Y	Y		X(1-4)				UNL(1-5)			
62	Y	N		X(1-4)	4(1-4)						
63	Y	Y					X (4)				
64	Y	Y				X (1-4)					
65	Y	N		X (1-4)					1 (1-5)		
66	Y	N		X(1-3)	X(4)				1(1-4)	1(4)	
67	Y	N	X(1-3)	X(1-4)				3(1-4)	2(1-4)		
68	Y	N	X (1-3)	X (1-4)				3 (1-4)	2 (1-4)		
69	Y	N	X (1-4)	X (1-4)				3 (1-5)	2 (1-5)		
70	Y	Y									
71	Y	N	X(1-3)	X(1-3)				3(1-3)			
72	Y	N	X(1-3)			X(1-2)		3(1-3)			
73	Y	N						3(1-3)			
74	Y	N		X(1-3)							
75	Y	N		X(1-3)							
76	Y	Y		X(1-4)			1(1-4)		1(1-4)		
77	Y	N	X (1-4)	X (1-4)				2 (1-5)	2 (1-5)		
78	Y	N		X (1-4)				2 (2-5)		1 (2-5)	
79	Y	N	X (1-4)	X (1-4)				2 (1-5)		1 (1-5)	
80	Y	N		X(2-4)			2(2-4)				
81	Y	N	X(2-4)			X(1)	2(1-5)	2(1-5)			
82	Y	N		X(1-4)	X(1-4)			1(1-5)		1(1-5)	
83	Y	N	X(2-4)	X(1-4)				2(2-5)	2(2-5)	2(2-5)	
84	Y	N		X (1-4)							
85	Y	N	X (1-4)	X (1-4)						1 (1-5)	
86	Y	N					X (1-4)				X (1-5)
87	Y	N	X (1-4)	X (1-4)				2 (1-4),1 (5)		1 (1-5)	
88	Y	N	X (1-4)	X (1-4)				2 (1-4),1 (5)		1 (1-5)	
89	Y	N	X (1-4)	X (1-4)							
90	Y	N	X	X				2(1-3)		1(1-3)	
91	Y	N		X (1-4)				2 (1-5)		1 (2-4)	
92	Y	N									
93	Y	N		X (1-3)				2 (1-3)		1 (1-3)	
94	Y	N		X (1-4)						2 (2-4)	
95	Y	N	X(1-4)								
96	Y	Y		X (1-4)							
97	Y	N		X (1-4)							X (1-4)
98	Y	N		X (1-4)			X (1-4)			1 (1-4)	
99	Y	N		X (1-4)				2 (1-5)			
100	Y	N		X (1-4)				2(1),3(2-5)		1(1),2(2-5)	
101	Y	Y	X (1-2,4)	X (1-2,4)	X (3)			2 (1-5)		1 (1-5)	
102	Y	N	X(3)	X(2-3)				X(1-2)		X(1-3)	
103	Y	N		X(1-3)				4(1-3)			
104	Y	N				X(1-4)				1(2-4)	
105	Y	N		X(1)		X(2-4)		1(1)			
106	Y	N		X(1-3)		X(4)		3(1-3)		1(1-3)	
107	Y	Y	X(4)	X(1-3)				1(1-2)			
108	N	N	X (1-2)	X (1-2)				1 (1-2)	1 (1-2)	1 (1-2)	
109	N						X			1(1-4)	X
110		N	X(1-2)	X(1-2)						X(1-4)	X
111	Y	N									
112	Y	N	X(1-2)	X(1-2)				1(1-3)			

Table II.1 (continued)

CRT.NO	0.9					0.10		0.11		0.12				
	0.9.1					0.10.1		0.11.2	0.11.3	0.12.1		0.12.2		0.12.3
	a	b	c	d	e	a	b			a	b	a	b	
1	X	X	X	X				Y	N					
2	X					X		Y	N	5	6	1 Y	3-4 M	Y
3	X		X	X				Y	N	46	12	5,2 M	8,2 M	Y
4	X					X		Y	N	4	6	0,5-1 Y	0,5 Y	Y
5	X			X				N	N					
6	X		X	X			X	Y	Y	6	11	1S	1S	Y
7			X	X		X		N	N	0	1	-	3 M	Y
8	X		X	X			X	Y	Y	69	32	1-2 S	1-2 S	Y
9	X			X				N	N					
10	X			X				N	N	3	5	1 Y	1 Y	Y
11	X							N	N					
12	X		X	X				N	N	7	29	5 Y	5 Y	Y
13	X		X	X				N	N					
14				X				N	N					
15	X		X	X				Y	N					
16	X		X	X		X		Y	Y					
17	X							N	N					
18	X		X	X				N	N					
19	X							N	N					
20	X		X	X				N	N					
21	X		X	X				N	Y					
22	X			X				N	Y					
23	X		X	X		X		N	N					
24	X			X				N	N					
25	X		X	X		X		Y	N					
26	X	X		X		X		Y	Y					
27	X	X		X		X		Y	N					
28	X	X		X			X	Y	Y		6			Y
29	X							Y	Y	49	20	4-9 M	4-9 M	Y
30														
31	X			X		X		N	N					
32	X	X		X		X	X	Y	N					
33	X	X		X		X	X	Y	N					
34	X	X		X		X	X	Y	N					
35	X	X		X		X	X	Y	Y	2	9	6-12 M	6-12 M	N
36	X					X		N	N					
37	X							N	Y					
38	X													
39	X	X		X		X		N	Y	51	8	1	1	Y
40	X	X		X		X		Y	N	51	8	1 Y	1 Y	Y
41	X							N	N					
42	X			X		X	X	Y	Y					
43														
44	X							Y	N					
45	X							N	N					
46														
47	X			X				N	N					
48	X	X		X				N	N	0	2	-	3 M	Y
49	X	X		X				N	N					
50	X			X	X	X		Y	N	16	18	1 S	1 S	N
51	X	X		X		X		N	N					
52	X	X		X	X	X		N	N	14	21	3-12 M	3-12 M	Y
53	X			X				N	N					
54	X	X	X	X		X		N	N					
55	X	X	X	X			X	N	N					
56	X	X	X	X		X		Y	Y					

Table II.1 (continued)

CRT.NO	0.9					0.10		0.11		0.12				
	0.9.1					0.10.1		0.11.2	0.11.3	0.12.1		0.12.2		0.12.3
	a	b	c	d	e	a	b			a	b	a	b	
57	X							Y	Y					
58			X	X		X		N	N	10-Aug	0-1	1 S-1Y	1 AY	Y
59			X					N	N					
60	X					X		N	N					
61					X	X		N						
62			X			X		N	N					
63		X			X		X	N	N	29	42	3-12 M	6-12 M	Y
64	X							N	N					
65	X							N	N	8	25	1 Y	1 Y	Y
66	X				X		X	Y	N					
67					X		X	Y	N					N
68	X		X				X	Y	Y	24	27	10D-3M	3-10 M	Y
69	X	X		X	X		X	Y	Y					
70	X	X		X		X	X	Y	Y	15	17	3M -1Y	3M-1Y	Y
71	X		X					N	N					
72	X	X					X	N	N					
73	X							Y	N					
74	X			X			X	Y	N					
75		X		X				N	N					
76	X			X		X	X	Y	Y					
77			X	X		X	X	N	N					
78			X	X		X		N	N		7		0,5 Y	Y
79			X	X		X	X	N	N	9	22	1 S	1 S	Y
80	X		X	X										
81			X	X				N	N					
82	X		X	X		X		N	N					
83	X	X	X	X		X		Y	N					
84		X				X	X	N	N					
85	X	X				X	X	Y	N	4	5	6 M	6-12 M	Y
86		X				X	X	N	N	19	18	11M -1Y	12M -1Y	Y
87			X	X		X		N	Y					
88			X	X		X		N	Y					
89														
90			X	X		X		N	N					N
91	X		X	X		X		N	Y					
92														
93	X		X	X		X		N	N					
94		X	X	X		X		Y	Y					
95			X	X			X	Y	Y					
96	X							Y	Y	50	20	1-2 S	1-2 S	Y
97	X			X				N	N					
98	X		X	X		X		N	Y					
99	X	X	X	X		X		N	Y	2	11	6 M	30-37 M	Y
100	X	X	X	X		X		N	Y					
101			X	X		X		N	Y					Y
102	X		X	X				N	N					
103		X			X			N	N					
104					X			N	N					
105	X		X	X	X			N	N					
106	X							N	N					
107	X	X	X	X		X	X	N	N					
108	X							N	N					
109	X		X	X				N	N					
110	X	X	X	X			X	N	N					
111	X	X					X	N	N	31	16	1-2 S	2 S	Y
112	X	X						N	N					

Table II.2 Qualification titles

CRT NO	COUNTRY	PROGRAMME (YEARS)	TYPE OF INSTITUTION	CITY	QUALIFICATION (IN NATIVE LANGUAGE)	QUALIFICATION (IN ENGLISH)
1	AT	5	U*	VIENNA	Diplom Ingenieur	-
2	BE	5	U	LIEGE	-	Civil Engineer
3	BG	5	U	SOFIA	-	Civil Engineer
4	CZ	5	U	PRAGUE	-	Civil Engineer
		5	U	PARDUBICE	-	Engineer of Transport
5	DE	5	U	BERLIN, DRESDEN, HAMBURG, LEIPZIG, MUNCHEN	Diplom Ingenieur	-
		4	UAS** (FH)	BERLIN, BIBERACH, ECKERNFORDE, ERFURT, FRANKFURT, KAISERSLAUTERN	Diplom Ingenieur FH	-
6	ES	6	U	BARCELONA	Ingeniero de Caminos	-
		6	U	MADRID	Ingeniero de caminos, canales y puertos	-
		6	U	SANTANDER	-	Civil Engineer
		5	U	VALENCIA	-	Civil Engineer (Superior) Gradute in Environmental Sciences
		3	U	VALENCIA	-	Civil Engineer (Technical)

* U – University; ** UAS – University of Applied Sciences (Fachhochschule);

Table II.2 (continued)

CRT NO	COUNTRY	PROGRAMME (YEARS)	TYPE OF INSTITUTION	CITY	QUALIFICATION (IN NATIVE LANGUAGE)	QUALIFICATION (IN ENGLISH)
7	FR	5	U	PARIS[1]	Ingenieur	-
		5	U	LYON[2]	-	Public works engineer
		5	U	LYON[3]	-	Civil and Urban Planning Engineer
		5	U	SAINT-ETIENNE	-	Civil Engineer
		4	U	BORDEAUX	Maîtrise de Genie Civil	-
		4	U	LILLE	-	Civil Engineering Degree and Maîtrise
8	GR	5	U	ATHENS, THESSALONIKI, PATRAS, VOLOS, XANTHI	-	Civil Engineer
		3.5	TEI**	PIREAS, SERES	-	Technologist for Building Works
		3.5	TEI	THESSALONIKI	-	Technologist for Infrastructures Works
		3.5	TEI	PIREAS	-	Civil Engineer for Building Works
9	HR	4.5	U	ZAGREB	-	BSc. Civil Engineering
10	HU	5	U	BUDAPEST	-	Civil Engineer
11	IE	4	U	CORK	-	B.Eng. (Civil)
		4	U	DUBLIN[4]	-	Civil Engineer
		4	U	DUBLIN[5]	-	Bachelor in Engineering
		4	U	WATERFORD	-	B.Sc. Construction Management
		4	U	GALWAY	-	Civil Engineer

* U –University; ** TEI - Technological Educational Institution; 1 – E.N.P.C; 2 – E.N.T.P.E.; 3 - I.N.S.A.; 4 – University College; 5 – Trinity College

Table II.2 (continued)

CRT NO	COUNTRY	PROGRAMME (YEARS)	TYPE OF INSTITUTION	CITY	QUALIFICATION (IN NATIVE LANGUAGE)	QUALIFICATION (IN ENGLISH)
12	IT	5	U*	FLORENCE, MILAN, TORINO	Laurea in Ingegneria Civile	Civil Engineer
13	LT	4	U	VILNIUS, KAUNAS	-	B Sc. in Civil Engineering
		4	U	KAUNAS	-	B. Sc.in Hydraulic Engineering
14	LV	3	U	RIGA	-	BSc. Civil Engineering
15	NL	5	U	DELFT	Civiel Ingenieur	Civil Engineer
16	NO	3	C**	NARVIK, PRORTSGRUNN, STAUANGER, TRONDHEIM	Hogskoleingenior	College Engineer
		4.5	U	TRONDHEIM	-	Civil Engineer
17	PL	5	U	BIALYSTOK, GDANSK, GLIWICE, KIELCE, WARSAW	-	Civil Engineer
		5	U	KRAKOVIA	-	MSc. in Civil Engineering
18	PT	5	U	COIMBRA, COVILHA, LISBON	Licenciatura	-
19	RO	5	U	BUCHAREST, CLUJ, IASI, TIMISOARA	Inginer Diplomat	Civil Engineer
		3	U	BUCHAREST	Inginer Colegiu	Civil Engineer Technical
20	SE	5	U	GOTEBORG	-	MSc. Civil Engineering
21	SI	5	U	LJUBLJANA	-	University Diploma Engineer
		4	U	LJUBLJANA	-	Diploma Engineer
		4	U	MARIBOR	-	University Civil Engineer

* U – University; ** C - College

Table II.2 (continued)

CRT NO	COUNTRY	PROGRAMME (YEARS)	TYPE OF INSTITUTION	CITY	QUALIFICATION (IN NATIVE LANGUAGE)	QUALIFICATION (IN ENGLISH)
22	SK	5	U*	BRATISLAVA, KOSICE, ZILINA	-	Civil Engineer
23	UK	4	U	BATH	-	M. Eng in Civil and Architectural Engineering
		4	U	CAMBRIGE	-	B. of Arts and M. of Engineering
		4	U	EDINBURGH	-	B. Eng. in Civil and Environmental Engineering
		4	U	GLASGOW	-	B. Eng.
		5	U	GLASGOW	-	M. Eng.
		3	U	LONDON[1], MANCHESTER, NOTTINGHAM, PORTSMOUTH	-	B. Eng.
		4	U	BRISTOL, DURHAM, LONDON[2], MANCHESTER, NOTTINGHAM	-	M. Eng.

* U – University; 1 - City University; 2 - City University and Imperial College

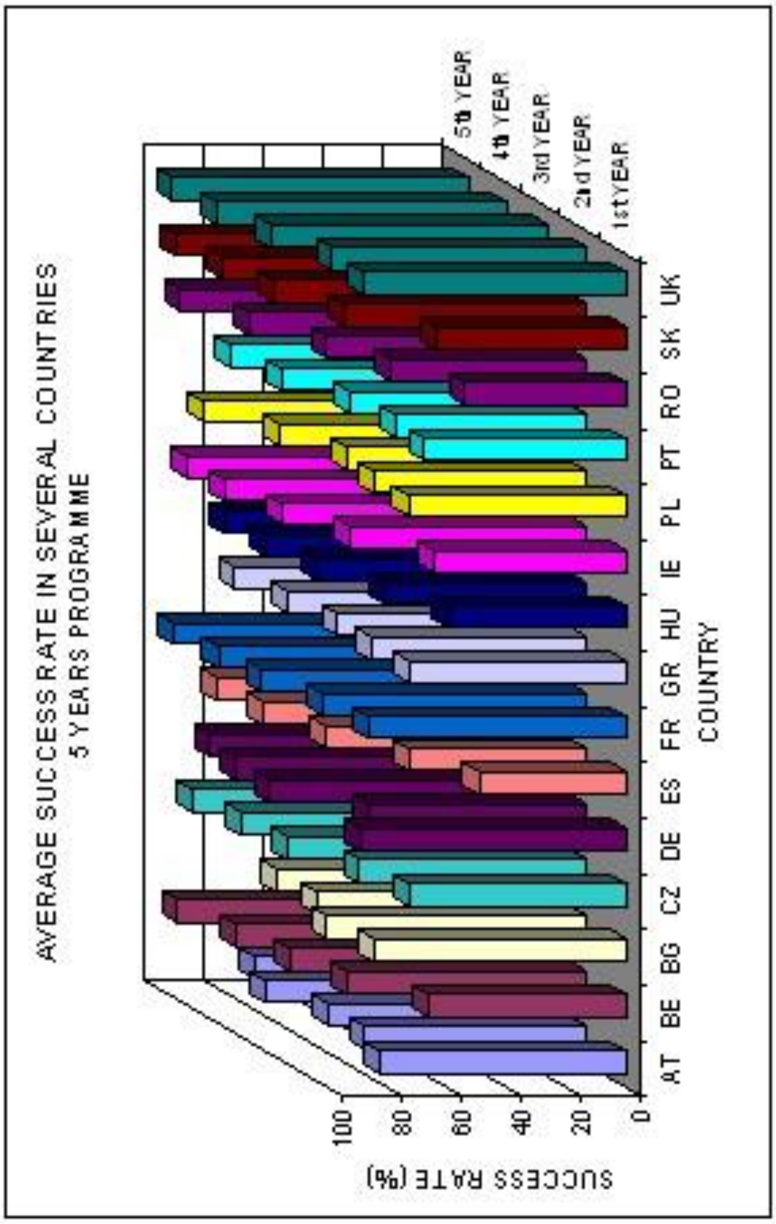


Figure II.26 Average success rates in various countries (5-year programme)

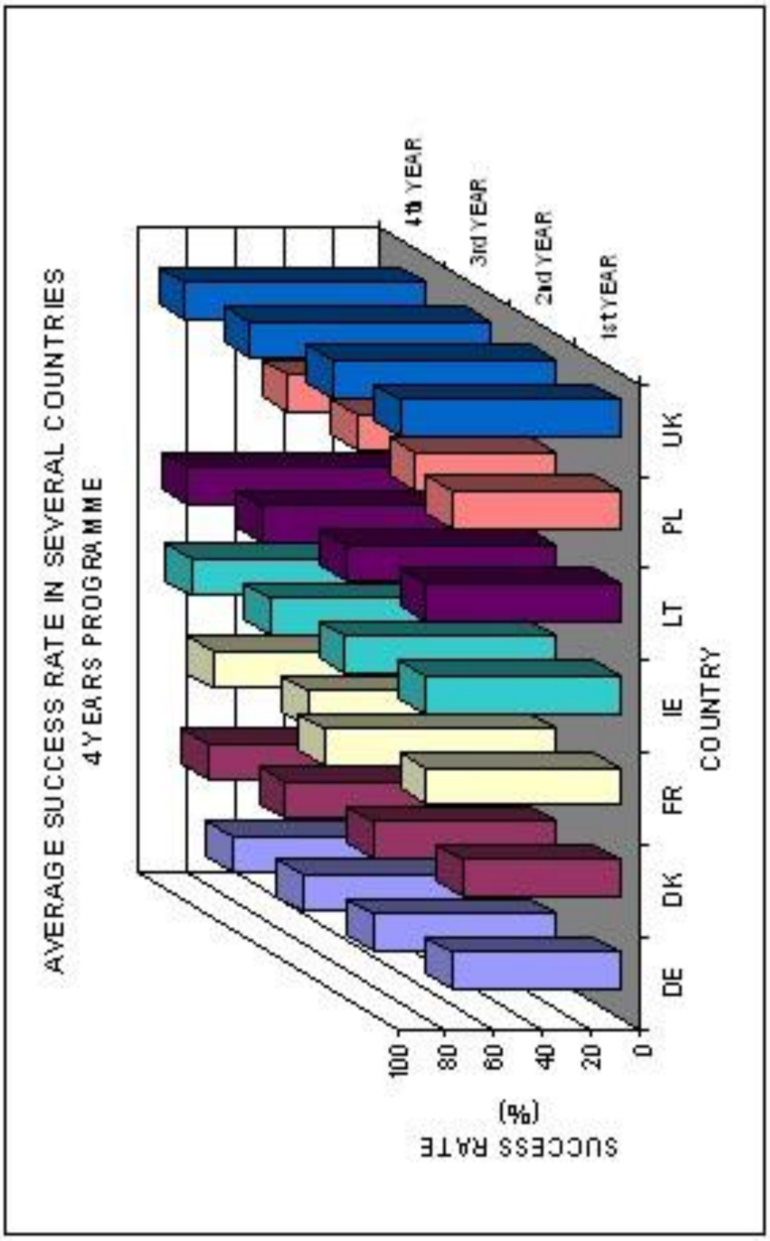


Figure II.27 Average success rates in various countries (4-year programme)

III STUDY ON THE CURRICULA STRUCTURE FOR THE FIRST CIVIL ENGINEERING DEGREE IN EUROPE

1. Data sources and processing method

The purpose of this study is to present a preliminary analysis on the received data, in order to draw out a conclusion regarding a common approach to civil engineering studies across Europe.

The data processing on the curricula structure in civil engineering education in Europe is based on the answers received to the first and second questionnaires distributed to all partner institutions.

Regarding the first questionnaire, a complete answer should contain the exhaustive list of course units along the 3 to 6 years of the academic calendar, as well as information on the total amount of contact hours, credits' allocation, examination type and so on (see first questionnaire in Annex I). The second questionnaire, discussed and approved at the meeting of Working Group A in London, contains the assignment of these course units to the categories A to H, as it was emphasised in the first part of this report.

From a total number of 113 received answers, only 44 are complete, meaning that respondents completed more or less the requested curricula information. Regarding the category assignment (Questionnaire 2), the number of received answers was even lower. However, because some of these institutions have several curricula, one for each specialisation (the Slovak University of Technology of Bratislava sent, for example, 20 different curricula), the total number of answers available for processing is 125. Nevertheless, when drawing conclusions from this analysis one must take into account the comments done before regarding the still limited number of data and the peculiarities of each institution.

Because of the different types of programmes and all their peculiarities, the following analysis was done by comparing only programmes of the same kind. In respect to this option, the total number of answers was divided according to the duration of studies. There were chosen for analysis the higher education programmes belonging to both continental and anglo-saxon system: the 5-year programme in 15 countries (33 institutions) and the 4-year programme in 5 countries (17 institutions).

Regarding the peculiarities of the answers, one should notice the absence in the curricula information from "Grands Ecoles" of France of the first two years, because these years, called "preparatory years" are spent in other institution. Therefore, an equivalent number of contact hours (and the corresponding assignment to categories) is very difficult to calculate.

In order to improve the reliability of data, the cumulative table with the received answers was sent to all contact persons for checking and correction. Although some figures had been noticed as being doubtful (for example, the total number of contact hours resulted for Italy), very few answers were received with appropriate corrections (DE, GR, PL).

As it was emphasised during the meetings of Working Group A, an analysis considering all disciplines listed in the curricula is almost impossible, taking into account at least two facts: firstly, the large number of disciplines in the same area with different denominations (but possible with the same or almost the same content) and secondly, the difficulties in assessing the course units' content only by their denomination. These were the main reasons behindthe decision of the Working Group A to consider in this study only the absolute and relative weight of the eight categories defined before. Also, because of the difficulty to assess the total number of contact hours spent in optional courses, every respondent was asked to assign himself the disciplines to the categories and to calculate the total number of contact hour per category. Table III.1 in the Annex III contains the list of answers received for category assignment and for the total number of contact hours per category. For a number of complete answers to the first questionnaire, but with no answer to the second one, the category assignment was done by the core members of the Working Group A. Although subjective in character, this approach allowed to enrich the database.

In a common approach with the processing of the first part of the questionnaire (Organisation of studies), the analysis was conducted by building a complete Excel table with all the received information regarding the total number of contact hours per categories (see Annex III). Then, the cumulative table has been divided according with the purposes of this analysis.

The main topics of this analysis are referring especially to the total number of contact hours (lecture + seminar + laboratory + project) per academic year, number of contact hours per category, weight of different categories along the academic calendar etc. Due to the incompleteness of the answers, a more in depth analysis, considering separately the total number of hours dedicated to lecture, seminar, laboratory or project was not possible at this stage of the analysis.

2. Total number of contact hours in various programmes

The first proposed task was to assess the load of students by calculating the total number of contact hours and the ratio of this value to the mean value of weeks in the academic calendar.

The comparison between the total number of contact hours among different programmes was made by splitting the cumulative table according to the two systems: 5-year programmes for the continental system and 4-year programmes for the anglo-saxon system. In both systems, the amount of data for programmes of shorter duration is not relevant enough to calculate distributions or mean values. Consequently, these data can be analysed directly by using the cumulative table in the Annex III.

For the continental long duration programme, the distribution of the total number of contact hours per country, as mean value of the received answers, is represented in figure III.1. In this processing, the records from France are disregarded and the values for the 6 years programme in Madrid were modified to an equivalent 5-year programme. Also, to avoid alteration of results by the differing weights of countries, due to the various number of answers (programmes), the mean values were calculated as following: firstly, the mean values per university (out of all specialisations) and, secondly, the mean value per country out of all respondent institutions.

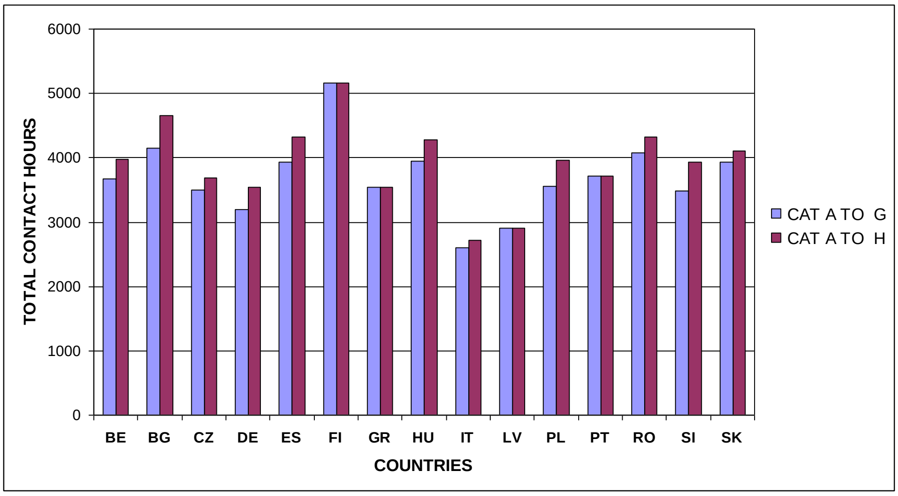


Figure III.1 Total contact hours in several countries (5-year programme)

For the 5 years programme, the total number of contact hours is between 2724 hours (IT) and 5160 hours (FI), with a mean value of 3923 hours. The graph is presenting both the total values with and without the category H (hours allocated to the final or diploma project). Both the extreme values (from Italy and Finland) should be considered with care, being well below, respectively above the mean value.

In order to emphasise the number of programmes as a function of the mean value of contact hours per year, the corresponding histogram is presented in figure III.2. For many of the analysed programmes (34 out of 80, representing 42.5%), the total number of contact hours per year is between 700 and 800.

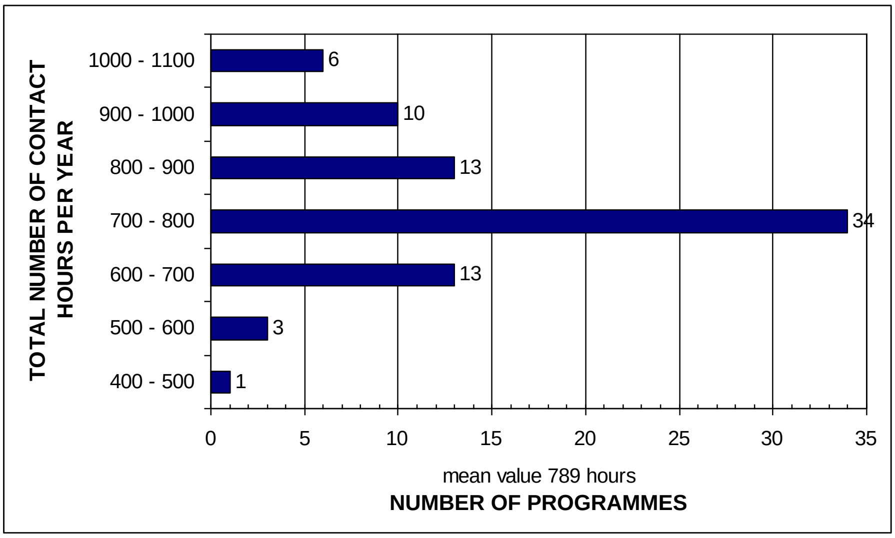


Figure III.2 Number of programmes versus mean teaching time (5-year programme)

Similar results were drawn out by analysing the 4 year programme, belonging to the anglo-saxon system. The distribution of the total number of contact hours per country, as mean value of the received answers, is represented in figure III.3. The mean values were calculated using the same rules as for the 5-year programme. The total number of contact hours is between 1999 hours (UK) and 4039 hours (LT), with a mean value of 3020 hours.

The histogram presenting the distribution of universities versus the mean value of contact hours is shown in figure III.4. In 6 out of 22 programmes (27.5%), the total number of contact hours per year is between 500 and 600.

The average number of contact hours per week in each programme was calculated by using the answers to the question No. 0.4.2 in the first part of the questionnaire. The results are the following:

- for the 5-year programme, an average of 26.8 hours/week, with a minimum of 18.5 hours/week and a maximum of 36 hours/week (see figure III.5);
- for the 4-year programme, an average of 24 hours/week, with a minimum of 16 hours/week and a maximum of 34 hours/week (see figure III.6).

For a more detailed picture, some figures in the Annex III are showing the distributions of total contact hours versus country and answers.

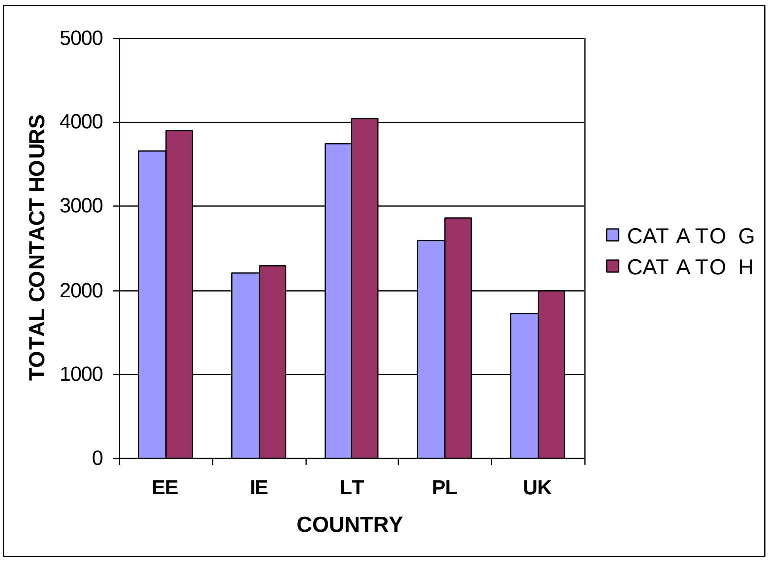


Figure III.3 Total contact hours in several countries (4-year programme)

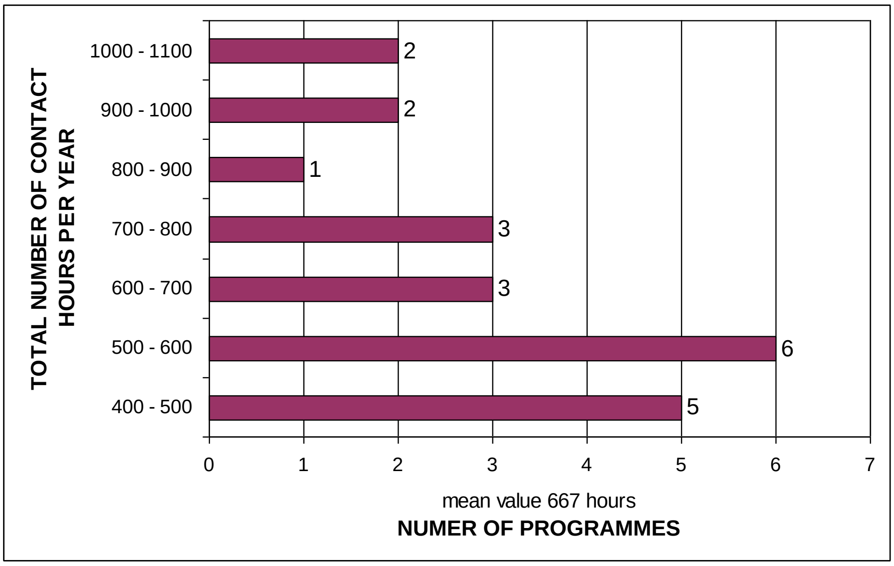


Figure III.4 Number of programmes versus mean teaching time (4-year programme)

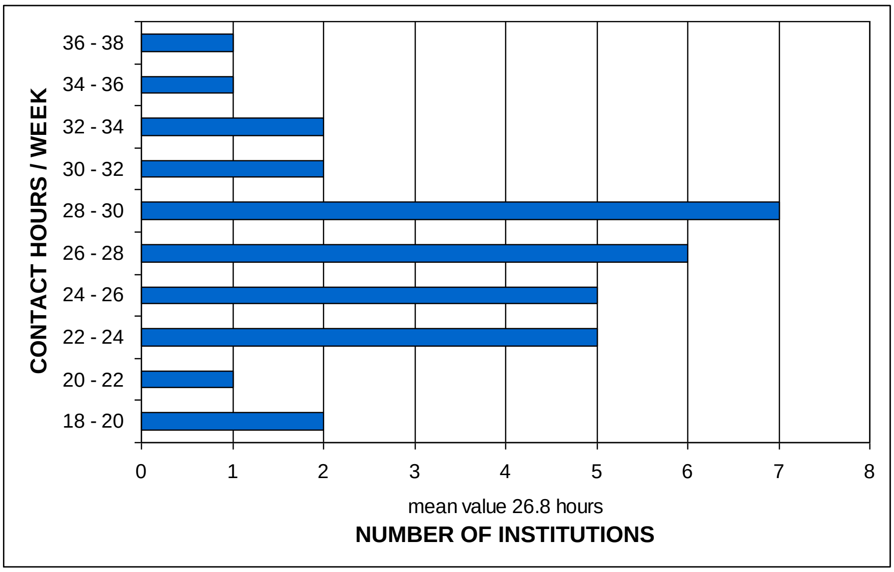


Figure III.5 Number of institutions versus number of contact hours per week (5-year programme)

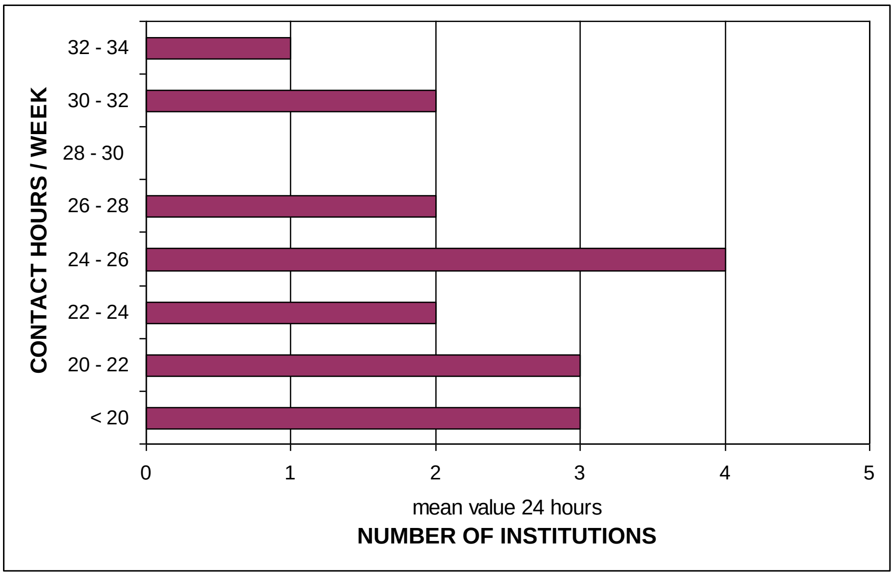


Figure III.6 Number of institutions versus number of contact hours per week (4-year programme)

3. Distribution of categories across academic years

For this topic the same approach was chosen, by dividing the answers based on different types of programmes.

Analysing the received data for the 5-year programme, it became obvious that for all programmes the first year is dedicated to the so-called Basic Sciences. In the second year the Engineering Sciences and the Core Engineering Subjects are dominating the curricula. Generally, the third year is dedicated to Core Engineering Subjects and Engineering Specialisations, while in the fourth and the fifth years Engineering Specialisations and Diploma Project are dominating the curricula. Figures III.7 to III.11 are presenting the distribution of the categories in each academic year, as an average value of all respondent institutions. Peculiarities of the mean values of different countries can be noticed in some graphs presented in Annex III.

To condense these results in order to draw out the evolution of content within years in each country, the amount of time spent in course units assigned to categories C and D versus the total amount of hours is printed in table III.2 in the Annex III. Out of the final line of the table (mean values), it appears that in the first year only 14% of the teaching time is devoted to civil engineering studies. The value rises to 36% in the second year and reaches 86 % in the fourth. Anyway, there is no indication of an acceptable level of qualification in civil engineering at the end of the third year.

The evolution of the curricula in terms of percetages corresponding in every year to the main categories, can be summarised as follows:

- out of a mean value of 813 hours in the first year, the Basic Sciences are dominating with an average amount of 377 hours (46%);
- out of a mean value of 805 hours in the second year, 463 hours (57%) are dedicated to Engineering Sciences and the Core Engineering Subjects;
- out of a mean value of 799 hours in the third year, 613 hours (77%) are dedicated to the Core Engineering Subjects and Engineering Specialisations;
- out of a mean value of 770 hours in the fourth year, 662 hours (86%) are dedicated to the Core Engineering Subjects and Engineering Specialisations;
- out of a mean value of 465 hours in the fifth year, 373 hours (80%) are dedicated to the Core Engineering Subjects and Engineering Specialisations;

From these information it appears that civil engineering is “picked up” by students in the third and fourth year.

Non-engineering subjects, as Humanities, Foreign Languages and Physical Training as well as Field Work are occupying an average of 5% to 9% each year out of the total amount of contact hours, while Economics and Management are taking up to 3% in each of the first three years, attaining 9% in the last academic year.

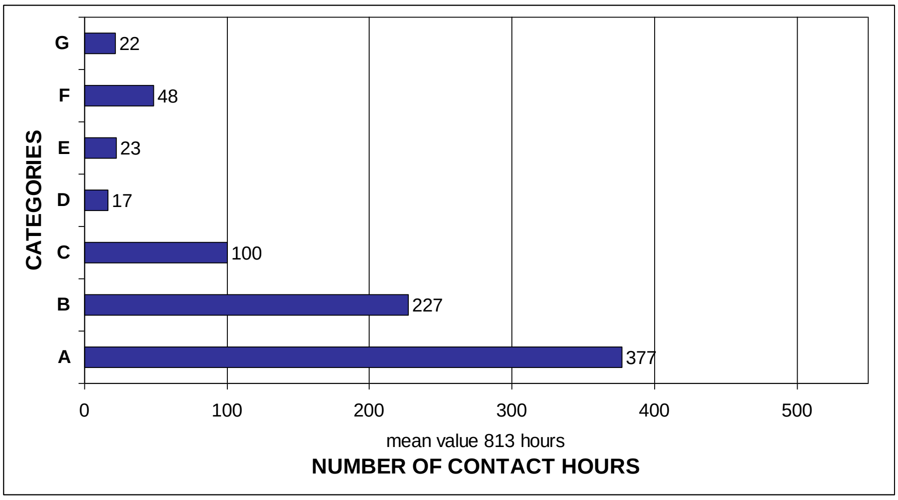


Figure III.7 Average number of contact hours/category – 1st year (5-year programme)

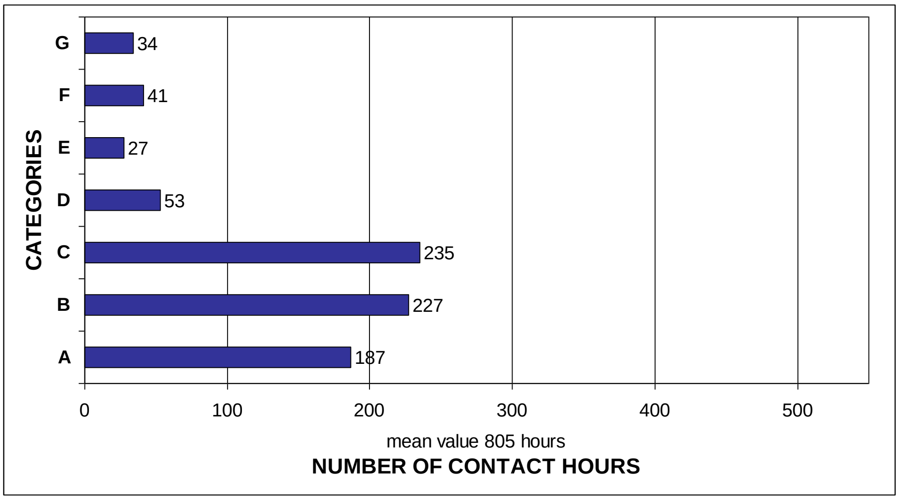


Figure III.8 Average number of contact hours/category – 2nd year (5-year programme)

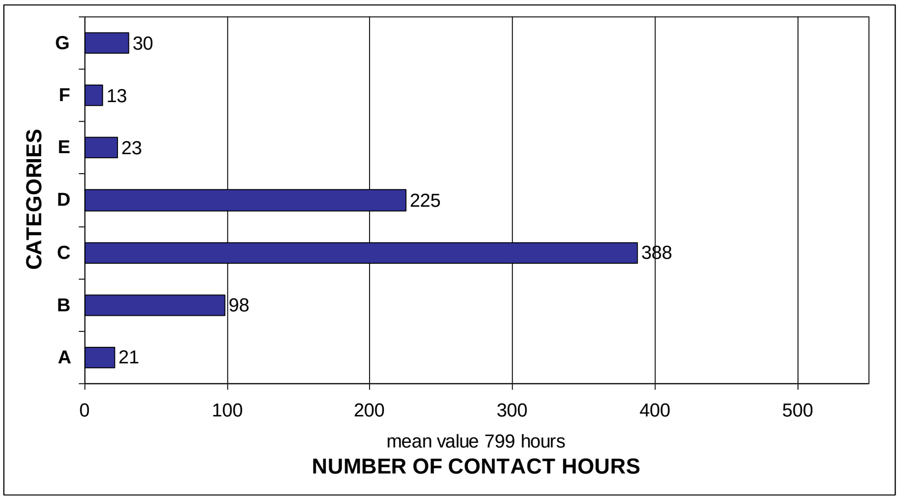


Figure III.9 Average number of contact hours/category – 3rd year (5-year programme)

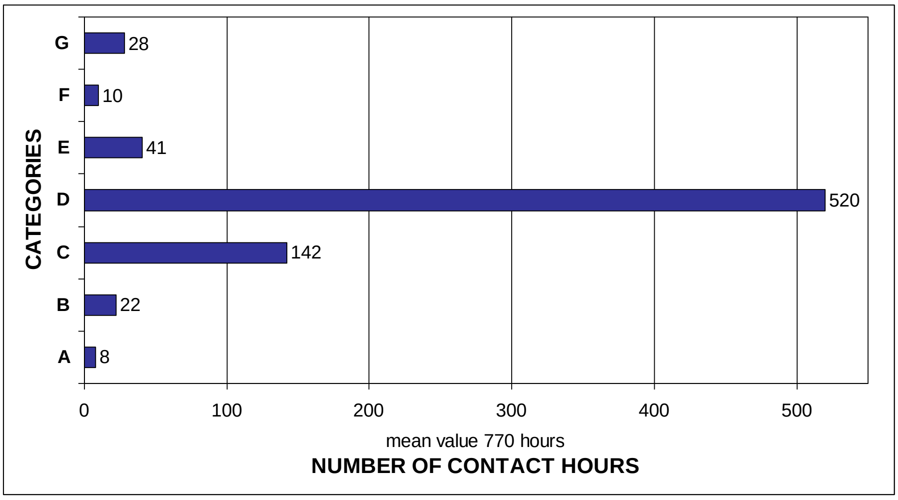


Figure III.10 Average number of contact hours/category – 4th year (5-year programme)

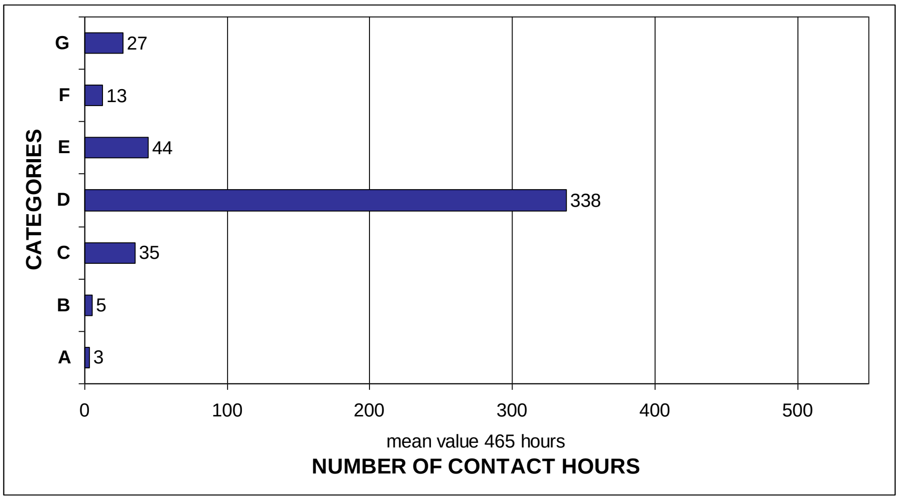


Figure III.11 Average number of contact hours/category – 5th year (5-year programme)

Similar distributions are presented for the 4-year programme in figures III.12 to III.15. The associated tables are leading to the following evolution of the curricula:

- in the first year, out of a mean value of 654 hours, Basic Sciences and Engineering Sciences, with almost the same weight, are covering together 402 hours (61%);
- in the second year, out of a mean value of 654 hours, 359 hours (55%) are dedicated to Engineering Sciences and the Core Engineering Subjects;
- in the third year, out of a mean value of 651 hours, the Engineering Specialisations are dominating with 313 hours (48%);
- in the fourth year, out of a mean value of 432 hours, Engineering Specialisations are covering 268 hours (62%).

Non-engineering subjects, as Humanities, Foreign Languages and Physical Training as well as Field Work are occupying an average of 11% to 16% each year out of the total amount of contact hours, while Economics and Management are taking up to 3% in the first year, attaining 20% in the fourth academic year.

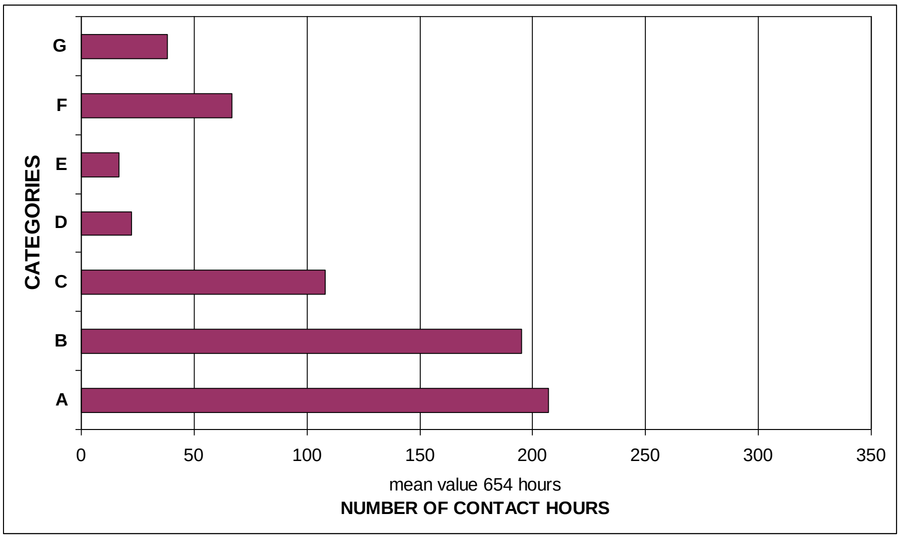


Figure III.12 Average number of contact hours/category – 1st year (4-year programme)

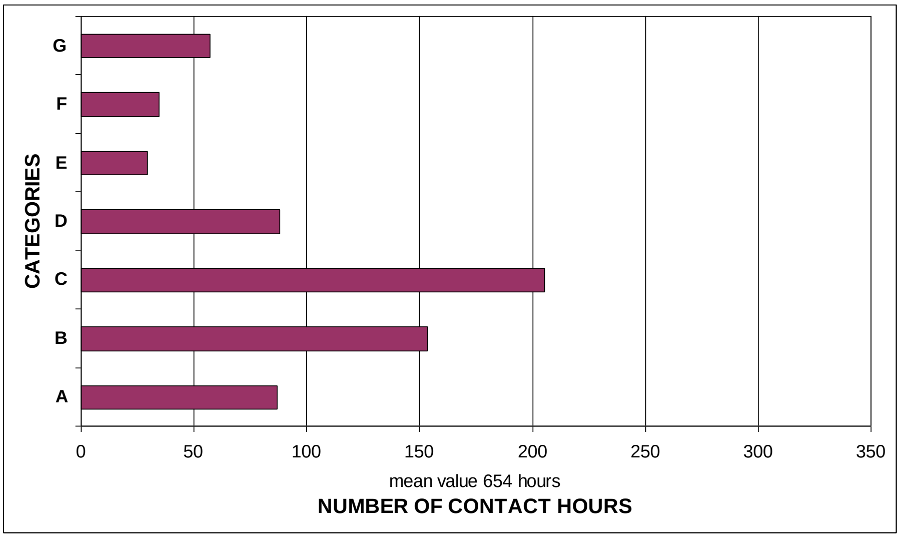


Figure III.13 Average number of contact hours/category – 2nd year (4-year programme)

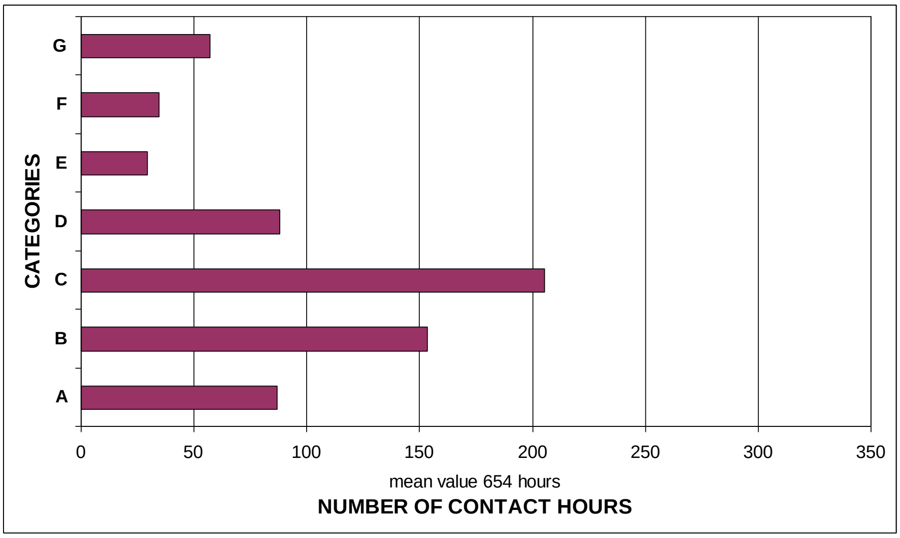


Figure III.14 Average number of contact hours/category – 3rd year (4-year programme)

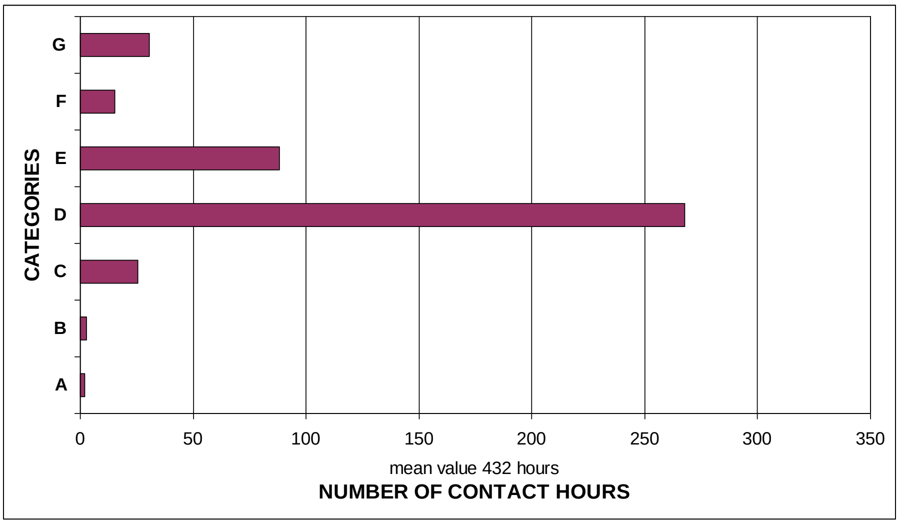


Figure III.15 Average number of contact hours/category – 4th year (4-year programme)

4. Weight of different categories in the curricula

The weight of different categories versus the total amount of contact hours was analysed firstly as an average of all received answers for every programme type. For the 5-year programme, the histogram of categories distribution is presented in figure III.16. Beside the mean value, the minimum and maximum values are added. The relative weight of each category as percentage of the total is presented in figure III.17.

The emerging feature is that the amount of time devoted to Core Civil Engineering Subjects and Engineering Specialisation (categories C and D) are dominant in the curricula. It is interesting to notice that the relative trends of the minimum and maximum values are following the average, irrespective of the total amount of contact hours.

Due to some incertitude on the category assignment, at the last meeting of Working group A it was proposed to add the values corresponding to categories C and D, in order to have a more clear picture on the weight of disciplines leading to civil engineering knowledge. As a result of this operation, Core Civil Engineering Subjects and Engineering Specialisation cover almost 58% of the curricula. Basic Sciences are on the next position, with an average of 16% followed by the Engineering Sciences with 15 %. Economics and FieldWork are on the 4th position with 4% of the curricula each, while Humanities and Languages cover 3%. The total amount of time dedicated to Final Project preparation is about 4% of the total average.

It is interesting to notice that Field Work (category G) is not always present in the curricula. Some institutions from DE, ES, FI, FR, GR, IT, PT did not assign any compulsory or optional field work.

The same remark can be made about Humanities and Languages (category F) for CZ (Pardubice), DE (Berlin), ES (Barcelona, Madrid), FI, IT (Milan and Florence), PT (Lisbon) and about the Final Project (category H) for BE (Louvain), DE (Dresden), ES (Barcelona), IT (Torino), PL (Krakow), PT.

Certainly, the lack of data in some of these examples is due to the incompleteness of the answers. In some cases, for instance in Greece, field work was allocated to a distinct discipline and thus to another category. In other cases the total amount of hours dedicated to the Final Project is included in some specialisation disciplines (category D).

Similar graphs for the 4-year programme are presented in the figures III.18 and III.19.

Another display of the received data is made in some figures in the Annex III, for both 5-year programme (in 15 countries) and 4-year programme (in 5 countries). In these graphs, the average values on each country (as nominal and percentage) were calculated and plotted versus the corresponding categories.

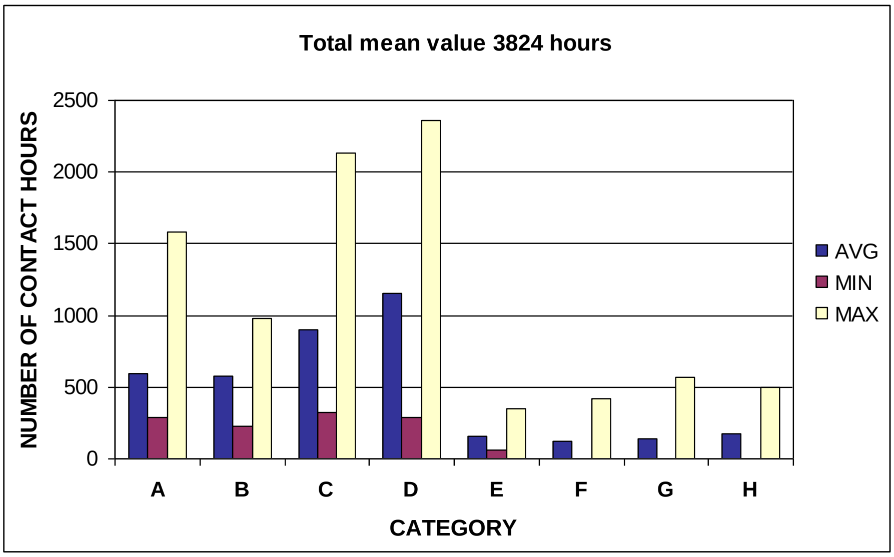


Figure III.16 Total number of contact hours per category (5-year programme)

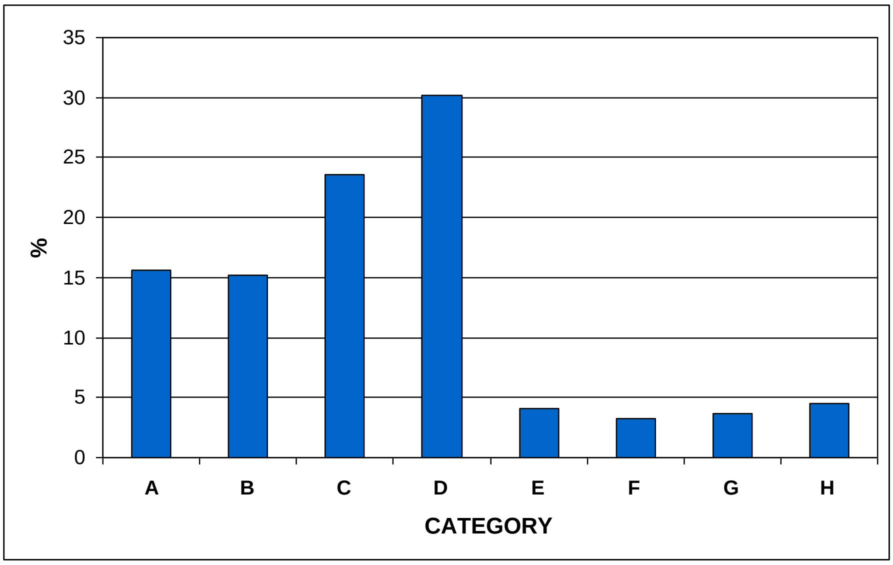


Figure III.17 Weights of different categories (5-year programme)

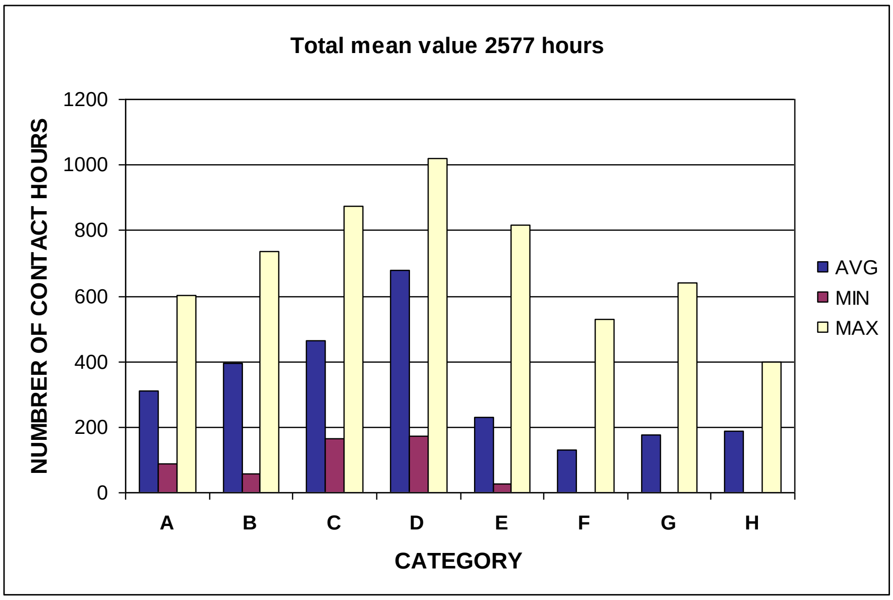


Figure III.18 Total number of contact hours per category (4-year programme)

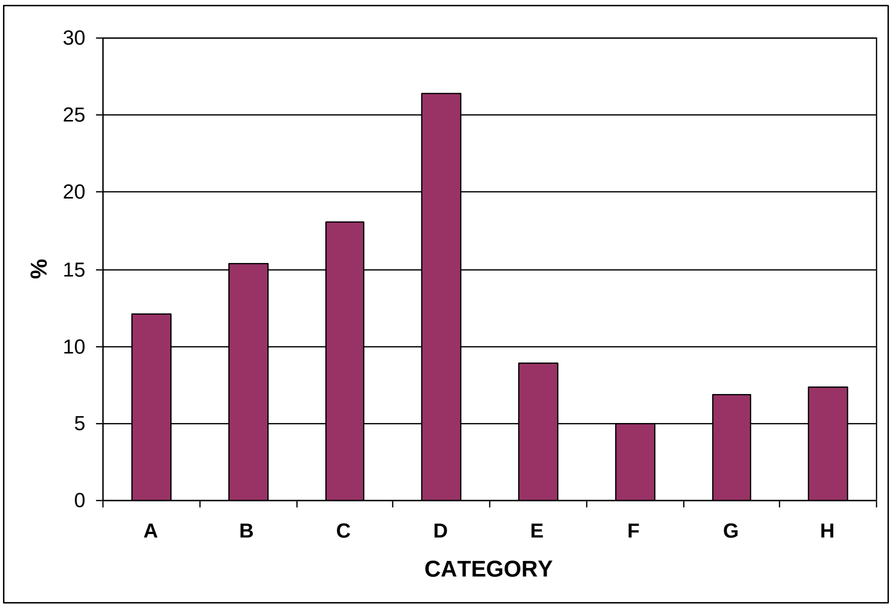


Figure III.19 Weights of different categories (4-year programme)

5. Individual characteristics across different countries

Displaying the received data only for one country and a specific academic year, one can draw out conclusions on the homogeneous pattern of the distribution. Because such an analysis can be accomplished only for countries with more than one available answer, only a few examples were chosen.

For the 5-year programme, the distribution of categories versus the received answers were displayed in figures III.20 and III.21 for the fourth year in Romania and Slovak Republic. For the 4-year programme, the same distributions are presented for the third year in United Kingdom and Poland (figures III.22 and III.23). The graphs are emphasising a random aspect of the distributions across institutions in various countries, from a quite uniform one (for instance in Romania and UK) to a more scattered aspect in others.

6. Concluding remarks

The civil engineering curricula in 22 European countries show a great diversity of disciplines and corresponding assigned teaching hours. Despite this diversity, it was possible to draw out some trends in the curricula structure from the received answers to the Working Group's A questionnaire. Based on the category assignment, the amount of teaching time devoted to each group of disciplines can be assessed in a reasonable way.

It is also true that in the framework of Working Group A rose the opinion that, for a consistent classification, a detailed list of subjects should be assigned to each category. Otherwise the classification could be subjective and the conclusions might be misleading. Noticeing a possible incertitude between categories C and D, a certain correction was accomplished by the core members of the Group when assessing these data together.

The anwers received and the resulting database express the situation in the academic year 1998 - 1999. It is certain that, as a result of local reforms (like, for instance, the new frame-law of 1998 in Germany) or of the implementation of measures agreed upon by Ministers of Education from 29 countries in Bologna in June 1999, changes are occurring or will occurr soon in the higher education system in some countries, with impact on civil engineering education, too. The picture obtained based on the survey of the Working Group A will be somehow modified.

A more detailed analysis of the curricula information is previewed to be done in the next outcome of Working Group A, a publication containing an exhaustive collection of the complete answers sent by the respondents, but also, more important National Reports reflecting the state-of-the-art and the trends in civil engineering education in the 27 countries. In the mean time, all the electronically received answers can be consulted in the EUCEET database for further analyses.

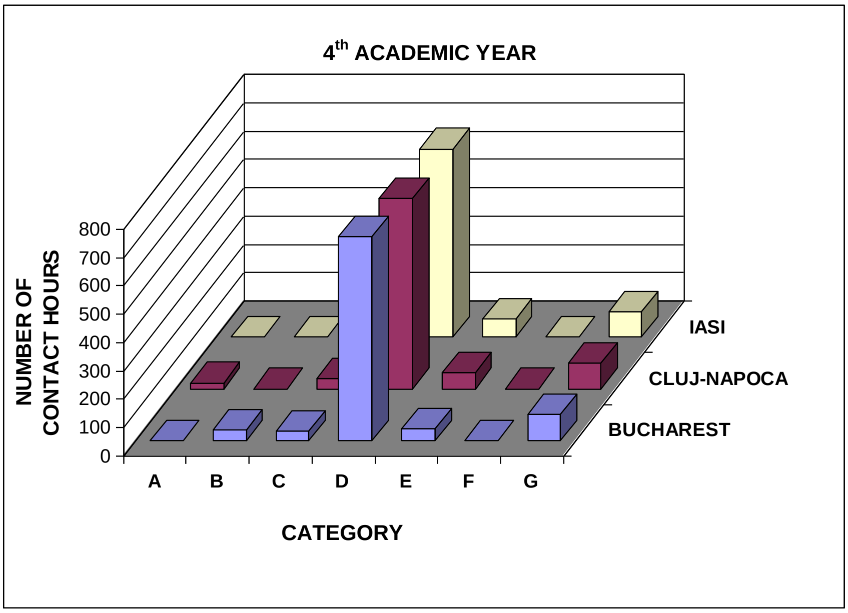


Figure III.20 Categories distribution in 3 different universities in Romania
4th year – 5-year programme

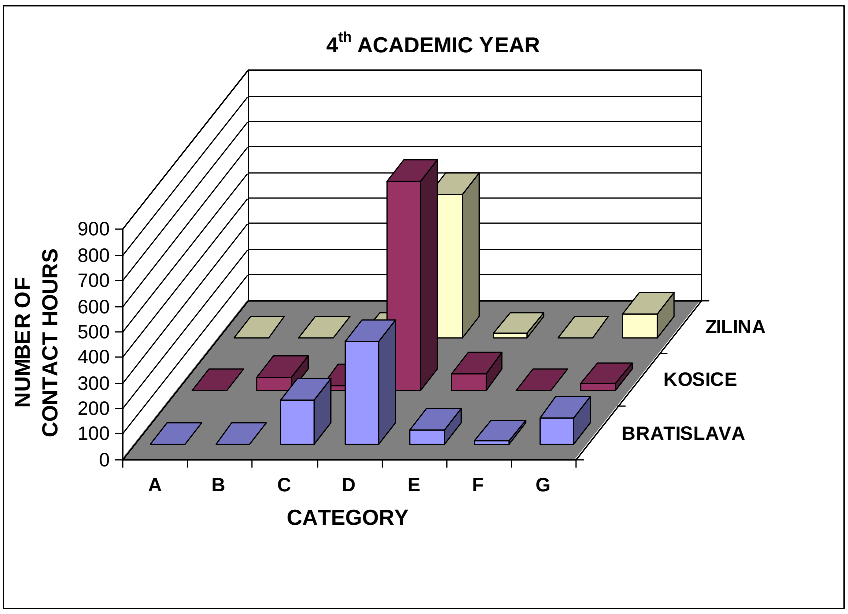


Figure III.21 Categories distribution in 3 different universities in Slovakia
4th year – 5-year programme

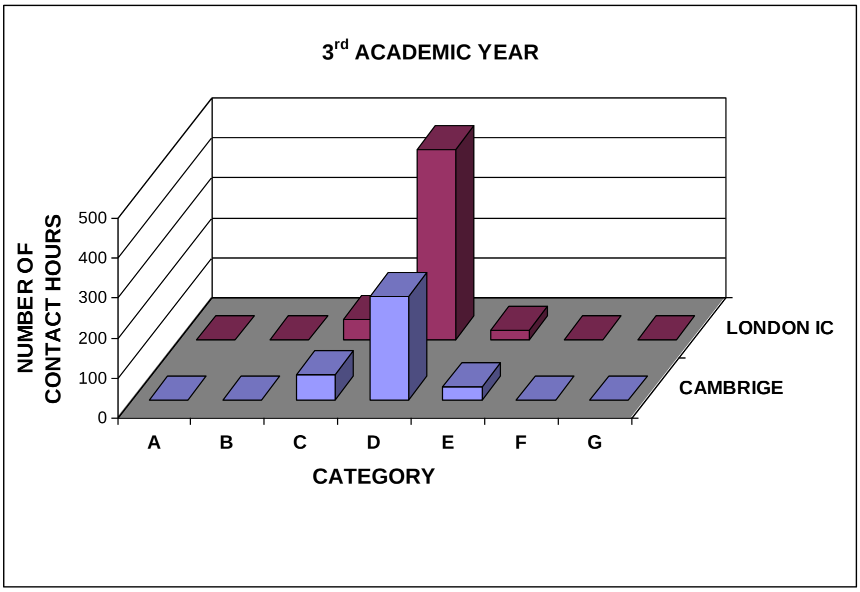


Figure III.22 Categories distribution in 2 different universities in United Kingdom
3rd year – 4-year programme

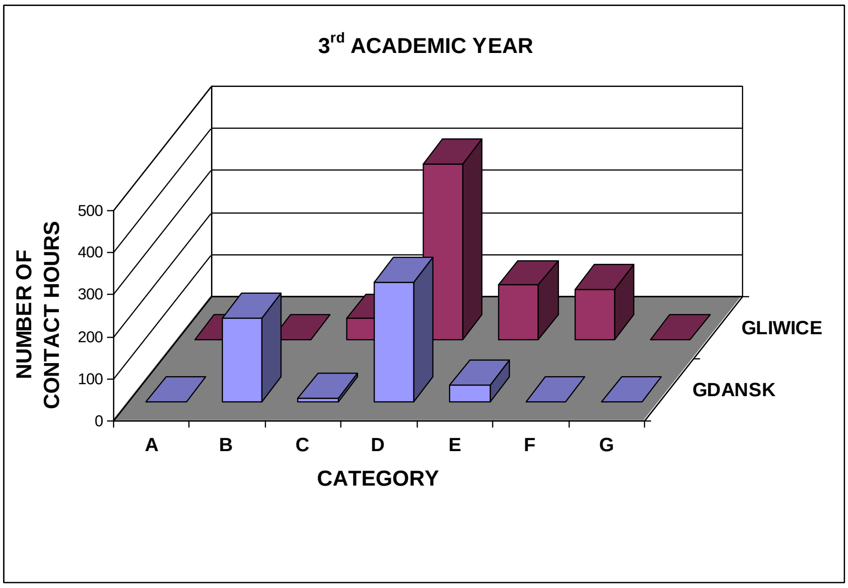


Figure III.23 Categories distribution in 2 different universities in Poland
3rd year – 4-year programme

Table III.1 Total number of contact hours vs. category and academic year

CATEGORY	ACAD YEAR	BE		BG		CZ			
		LIEGE	LOUVAIN	SOFIA		PARDUBICE	PRAGUE	BRNO	
				STR	TECH			STR	TECH
A	1	450	360	390	390	308	336	364	364
	2	350	412.5	165	165	322	126	168	168
	3		45						
	4								
	5								
	6	-	-	-	-	-	-	-	-
TOTAL A		**800**	**817.5**	**555**	**555**	**630**	**462**	**532**	**532**
B	1	110	225	375	375	148	182	210	210
	2	280	225	195	195	168	42	112	112
	3	310	285	60	60	322			
	4	110	150						
	5								
	6	-	-	-	-	-	-	-	-
TOTAL B		**810**	**885**	**630**	**630**	**638**	**224**	**322**	**322**
C	1			120	120		56	140	140
	2			360	360	56	336	434	434
	3	480	405	525	525	322	462	196	196
	4	145	67.5	225	225		266		
	5						112		
	6	-	-	-	-	-	-	-	-
TOTAL C		**625**	**472.5**	**1230**	**1230**	**378**	**1232**	**770**	**770**
D	1					98			
	2			45	45	154	196		
	3			240	240	140	224	518	518
	4	555	675	555	555	770	420	616	616
	5	390	442.5	345	345	290	518	374	77
	6	-	-	-	-	-	-	-	-
TOTAL D		**945**	**1117.5**	**1185**	**1185**	**1452**	**1358**	**1508**	**1211**
E	1	30				112	42	28	28
	2	20	30			112			
	3	15	45				56		
	4	30	45	105	105		42	112	112
	5		52.5	105	105	126	28		33
	6	-	-	-	-	-	-	-	-
TOTAL E		**95**	**172.5**	**210**	**210**	**350**	**168**	**140**	**173**
F	1	50	90	120	120		70	84	84
	2	50	60					28	28
	3								
	4								
	5		15					22	22
	6	-	-	-	-	-	-	-	-
TOTAL F		**100**	**165**	**120**	**120**	**0**	**70**	**134**	**134**
G	1			72	72	43	48	60	60
	2	16		30	30			60	60
	3		104	120	120	43			
	4		104			85			
	5	120							
	6	-	-	-	-	-	-	-	-
TOTAL G		**120**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
H		300		500	500	46	420	132	154

Table III.1 (continued)

CATEGORY	ACAD YEAR	DE							DK
		BERLIN AS	BERLIN TU	MUNICH	DRESDEN	BIBERACH	ECKERN FORDE	KAISERS LAUTERN	ODENSE
A	1	204	304	338	195	252	192	238	270
	2	34		68	90			88	90
	3								
	4								-
	5	-							-
	6	-	-	-	-	-	-	-	-
TOTAL A		**238**	**304**	**406**	**285**	**252**	**192**	**326**	**360**
B	1	170	268	150	300	224	120	150	
	2	34	192	124	165	28	120	125	
	3			73		28			80
	4								-
	5	-							-
	6	-	-	-	-	-	-	-	-
TOTAL B		**204**	**460**	**347**	**465**	**280**	**240**	**275**	**80**
C	1	646	204	240	255	280	240	260	570
	2	442	608	382	180	112	180	163	190
	3		668	289	255	28	36	138	100
	4		225		135				-
	5	-							-
	6	-	-	-	-	-	-	-	-
TOTAL C		**1088**	**1705**	**911**	**825**	**420**	**456**	**561**	**860**
D	1	34				84	96	25	100
	2	510		52	240	224	260	275	380
	3	408		537	375	280	480	575	680
	4		435	496	495			550	-
	5	-	225		75				-
	6	-	-	-	-	-	-	-	-
TOTAL D		**952**	**660**	**1085**	**1185**	**588**	**836**	**1425**	**1160**
E	1					28			
	2	34	28		60	56	50	25	265
	3		76	70,5	45	56			180
	4				30				-
	5	-							-
	6	-	-	-	-	-	-	-	-
TOTAL E		**34**	**104**	**0**	**135**	**140**	**50**	**25**	**445**
F	1	68		60					
	2	68			30				
	3				30				
	4				60				-
	5	-							-
	6	-	-	-	-	-	-	-	-
TOTAL F		**136**	**0**	**60**	**120**	**0**	**0**	**0**	**0**
G	1			40				160	
	2			462		500	320	160	
	3	450				500		240	
	4							240	-
	5	-							-
	6	-	-	-	-	-	-	-	-
TOTAL G		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
H			400	315			300		500

Table III.1 (continued)

CATEGORY	ACAD YEAR	EE	ES							
		TALLIN	BARCE LONA	MADRID				VALENCIA		
				STR	TRNS	HYDR	TWN.PL	C.E.	BLD	TRNS
A	1	328	330	560	560	560	560	405	405	405
	2	80	90	300	300	300	300			
	3		165					370	370	370
	4									
	5	-								
	6	-	-					-	-	-
TOTAL A		**408**	**585**	**860**	**860**	**860**	**860**	**775**	**775**	**775**
B	1	272	285	75	75	75	75	225	225	225
	2	336	345	365	365	365	365	75	75	75
	3	48	255	340	340	340	340	60	60	60
	4		90							
	5	-								
	6	-	-					-	-	-
TOTAL B		**656**	**975**	**780**	**780**	**780**	**780**	**360**	**360**	**360**
C	1	64								
	2	332	300					480	480	480
	3	336	150	320	320	320	320	315	315	315
	4	144		400	400	400	400			
	5	-		38						
	6	-	-					-	-	-
TOTAL C		**876**	**450**	**758**	**720**	**720**	**720**	**795**	**795**	**795**
D	1							450	450	450
	2		60					450	450	450
	3	288	120					225	225	225
	4	200	660	175	175	175	175	795	795	795
	5	-	510	585	510	585	625	180	180	180
	6	-	-	624	549	649	649	-	-	-
TOTAL D		**488**	**1350**	**1384**	**1234**	**1409**	**1449**	**2100**	**2100**	**2100**
E	1	26	60							
	2	80						105	105	105
	3	336								
	4	376		75	75	75	75	60	60	60
	5	-			37.5		37.5	60	60	60
	6	-	-	37.5	162.5	50	50	-	-	-
TOTAL E		**818**	**60**	**112.5**	**275**	**125**	**162.5**	**225**	**225**	**225**
F	1	30								
	2	30								
	3	30		80	80	80	80			
	4	30		80	80	80	80			
	5	-		53	53	53	53			
	6	-	-					-	-	-
TOTAL F		**120**	**0**	**213**	**213**	**213**	**213**	**0**	**0**	**0**
G	1	90								
	2	90								
	3	120								
	4									
	5	-								
	6	-	-					-	-	-
TOTAL G		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
H		240						400	400	400

Table III.1 (continued)

CATEGORY	ACAD YEAR	FI	FR			GR				
		HELSINKI	BORDEAU	CACHAN	ST. ETEINE	PATRAS	SERES	THESSALONIKI		VOLOS
								T.E.I.	A.U.	
A	1	880			402	325	360	450	325	308
	2	700			128	143	180	60	52	126
	3		100	44	48					
	4		100	102	48					
	5			50						
	6									
TOTAL A		**1580**	**200**	**196**	**626**	**468**	**540**	**510**	**377**	**434**
B	1	380			112	442	600	390	169	322
	2	200			192	234	375	150	260	112
	3		150	198	47		120	30	130	70
	4		40	40	92					
	5									
	6									
TOTAL B		**580**	**190**	**238**	**443**	**676**	**1095**	**570**	**559**	**504**
C	1	320			304			165	104	140
	2				128	455	375	585	457	350
	3		170	300	192	962	390	150	468	308
	4		285	130	88	715				56
	5				32					
	6									
TOTAL C		**320**	**455**	**430**	**744**	**2132**	**765**	**900**	**1029**	**854**
D	1									
	2				272			75		
	3	800	120	100	32		300	615	156	378
	4	800	200	172	112	78			689	574
	5	760		418	308	234			429	392
	6									
TOTAL D		**2360**	**320**	**690**	**724**	**312**	**300**	**690**	**1274**	**1344**
E	1	120							78	
	2	80			168	65		60		
	3	120			64		150	165		84
	4				80				65	
	5				92					56
	6									
TOTAL E		**320**	**0**	**0**	**404**	**65**	**150**	**225**	**143**	**140**
F	1				656	78		30		112
	2				224	78	30	45		
	3		20	40	176			30		
	4		25	40	192					
	5				48					
	6									
TOTAL F		**0**	**45**	**80**	**1296**	**156**	**30**	**105**	**0**	**112**
G	1									
	2									50
	3				550					
	4				550					
	5									
	6									
TOTAL G		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
H					550		700	700		

Table III.1 (continued)

CATEGORY	ACAD YEAR	HU	IE			IT		
		BUDAPEST	DUBLIN TC	DUBLIN UC	CORK NU	TORINO	MILANO	FIREZE
A	1	392	360	204	424	360	350	400
	2	140	132	96	162	180	150	280
	3		110	96				
	4						150	
	5						50	50
	6							
TOTAL A		**532**	**602**	**396**	**586**	**540**	**700**	**730**
B	1	350	252	66	168	160	100	200
	2	350	332	216	267	160	250	150
	3	70		140	184	80	50	80
	4				44		100	
	5						50	
	6							
TOTAL B		**770**	**584**	**422**	**663**	**400**	**550**	**430**
C	1		60	24	57		100	
	2	238	148	384	102	80	50	
	3	644	264	66	48	240	300	400
	4	56	148			80	150	350
	5						250	500
	6							
TOTAL C		**938**	**620**	**474**	**207**	**400**	**850**	**1250**
D	1							
	2						100	50
	3		33	208	283	160	150	88
	4	462	139	326	427	160	200	150
	5	392				480		
	6							
TOTAL D		**854**	**172**	**534**	**710**	**800**	**450**	**288**
E	1	70					50	
	2	28			48	80	50	80
	3	42	44	48	102			
	4	112	45	48	92			
	5							
	6							
TOTAL E		**252**	**89**	**96**	**242**	**80**	**100**	**80**
F	1			24				
	2	56			100			
	3	28					50	
	4	84						
	5	112						
	6							
TOTAL F		**280**	**0**	**24**	**100**	**0**	**50**	**0**
G	1							
	2	88						
	3	72	115				50	
	4	160						
	5						50	
	6							
TOTAL G		**0**	**0**	**0**	**0**	**0**	**50**	**0**
H		336	100	24	132		150	100

Table III.1 (continued)

CATEGORY	ACAD YEAR	LT				LV	NO	
		KAUNAS		VILNIUS		RIGA	NARWIK	TRONDHEIM
		UA	UT	STR	TECH&MNG			
A	1	352	288	416	416	272	315	420
	2	128	244	96	96	64	112	196
	3							84
	4							
	5							
	6							
TOTAL A		**480**	**532**	**512**	**512**	**336**	**427**	**700**
B	1	240	368	256	256	192	280	280
	2	270	288	480	480	240		
	3	32	80					
	4					32		
	5							
	6							
TOTAL B		**542**	**736**	**736**	**736**	**464**	**280**	**280**
C	1	128	80				70	
	2		240	224	224	160	168	378
	3	152	304	640	176	368	50	84
	4			48	48			
	5							
	6							
TOTAL C		**280**	**624**	**912**	**448**	**528**	**288**	**462**
D	1							84
	2	128				96	224	56
	3	432	304		464	176	190	420
	4	460	432	396	264	576		360
	5					272		
	6							
TOTAL D		**1020**	**736**	**396**	**728**	**1120**	**414**	**920**
E	1					128	35	
	2		80	64			56	70
	3	160	128	208	256		150	112
	4	96	192	72	252	16		
	5							
	6							
TOTAL E		**256**	**400**	**344**	**508**	**144**	**241**	**182**
F	1	140	400	288	288	64		
	2	188			48	100		
	3		64					
	4		64	60	24			
	5							
	6							
TOTAL F		**328**	**528**	**348**	**360**	**164**	**0**	**0**
G	1	200	160	40	40	64		
	2	160	160	188	188	90		
	3	200	160	175	175			
	4		160					
	5							
	6							
TOTAL G		**0**	**0**	**0**	**0**	**0**	**0**	**0**
H			160	350	350		100	

Table III.1 (continued)

CATEGORY	ACAD YEAR	PL					PT	
		GDANSK	GLIWICE	KRAKOW	WARSAW		COVILHA	LISBON
					BS	MS		
A	1	240	210	315	270	270	375	450
	2	60	45	105	75	75	450	300
	3							
	4					60		
	5							
	6							
TOTAL A		**300**	**255**	**420**	**345**	**405**	**825**	**750**
B	1	195	233	165	255	255	375	180
	2	150		255	210	210	225	300
	3	200		75			225	75
	4				45	30		
	5							
	6							
TOTAL B		**545**	**233**	**495**	**510**	**495**	**825**	**555**
C	1	150	217	90	120	120		120
	2	345	325	195	345	345	75	150
	3	10	50	315	615	615	525	675
	4				0	98	425	600
	5							150
	6							
TOTAL C		**505**	**592**	**600**	**1080**	**1178**	**1025**	**1695**
D	1		30					
	2	75	255					
	3	428	420	360				
	4	385	30	675	330	424	325	120
	5			225	0	319	575	420
	6							
TOTAL D		**745**	**735**	**1260**	**330**	**743**	**900**	**540**
E	1							
	2	60	50	30	60	60		
	3	60	130		150	150		
	4	103	0	75	60	64		
	5			45	0	19	148	60
	6							
TOTAL E		**203**	**180**	**150**	**270**	**293**	**148**	**60**
F	1	150	30	105	60	60		
	2	90	60	90	60	60		
	3		120	60				
	4	40	45		0	90		
	5				0	90	30	
	6							
TOTAL F		**280**	**255**	**255**	**120**	**300**	**30**	**0**
G	1			165	60	60		
	2				60	60		
	3		0		90	90		
	4		360					
	5							15
	6							
TOTAL G		**0**	**0**	**0**	**0**	**0**	**0**	**15**
H			270		240	400		

Table III.1 (continued)

CATEGORY	ACAD YEAR	RO					SI		
		BUCHAREST		CLUJ		IASI	LJUBLIANA		MARIBOR
		TU	TECH.COL.	TU	EC.COL.		MS	BC	
A	1	350	280	336	238	350	405	240	270
	2	210		126		126	180	45	210
	3			28			45		
	4			21					
	5								
	6								
TOTAL A		560	280	511	238	476	630	285	480
B	1	266	364	224	322	182	195	210	225
	2	387		378		338	345	120	45
	3	107		77			114		105
	4	56					9		
	5	33		28					
	6								
TOTAL B		831	364	707	322	520	663	330	375
C	1	140	70	140	168	140	285	240	225
	2	126	308	84	112	98	255	435	285
	3	392		315		427	306	60	465
	4	33		35			108		135
	5	33		21					
	6								
TOTAL C		723	378	595	280	665	954	735	1110
D	1								
	2	19	378	84	490	154			45
	3	285	434	364	202	357	351	651	255
	4	719		672		665	690		570
	5	373		343		343			
	6								
TOTAL D		1395	812	1463	692	1519	1041	651	870
E	1							60	60
	2		112		112		60	60	120
	3	14	140		370		24	69	
	4	42		56		63	102		120
	5	79		105		98			
	6								
TOTAL E		135	252	161	482	161	186	189	300
F	1	84	126	140	112	140			
	2	98	42	168	28	98			
	3		28		16			108	
	4								
	5					63			
	6								
TOTAL F		182	196	308	156	301	0	108	0
G	1	20	120	90	108		15		
	2		120	90	72	90			
	3	90		90	72	90			
	4	90		90		90			
	5			210					
	6								
TOTAL G		0	240	210	0	0	0	0	0
H		209	196	294	216	276	450		

Table III.1 (continued)

CATEGORY	ACAD YEAR	SK			UK			
		BRATISLAVA	KOSICE	ZILINA	BATH	BRISTOL	CAMBRIGE	DURCHAM
A	1	340	616	336	108	72	62	88
	2	145	210	96	54	72	34	
	3		7			20		
	4							
	5							
	6							
TOTAL A		**485**	**833**	**432**	**162**	**164**	**96**	**88**
B	1	71	224	132	108	256	165	388
	2	58	266	168	54		90	88
	3	101	123	16	81			
	4		54					
	5		21					
	6							
TOTAL B		**230**	**688**	**316**	**243**	**256**	**255**	**476**
C	1	251	84	144	216	195	66	
	2	457	504	360	108	207	36	187
	3	596	132	20	108		64	
	4	181	21	16				95
	5	23						
	6							
TOTAL C		**1508**	**725**	**540**	**432**	**402**	**166**	**282**
D	1				108		206	
	2		42		270	157	178	38
	3		579	640	324	539	260	228
	4	388	821	560	189	128	320	19
	5	407	369	232				
	6							
TOTAL D		**796**	**1811**	**1432**	**891**	**824**	**964**	**285**
E	1	20					8	
	2	19			27	34	8	44
	3		12	16	54	30	32	38
	4	58	65	48	54	90		
	5	70	133	40				
	6							
TOTAL E		**160**	**210**	**72**	**135**	**154**	**48**	**82**
F	1	36	196	24				
	2	121	168	60				
	3	114	56					
	4	11						
	5	33						
	6							
TOTAL F		**315**	**420**	**84**	**0**	**0**	**0**	**0**
G	1					60		
	2	26		60	70	20		66
	3	61	86	13		24		89
	4	102	26	93				
	5	8	34					
	6							
TOTAL G		**8**	**34**	**0**	**0**	**0**	**0**	**0**
H		125	243	320	220	320	320	304

Table III.1 (continued)

CATEGORY	ACAD YEAR	UK						
		EDINBURGH	GLASGOW		LONDON		NOTTINGHAM	PORTSMOUTH
			BS	MS	I.C	C.U.		
A	1	90	102	102	100	72	300	72
	2	70	50	50	78	72	90	36
	3			50				
	4					36		
	5							
	6							
TOTAL A		**160**	**152**	**202**	**178**	**180**	**390**	**108**
B	1		59	59	180	108	30	92
	2				22	18		
	3							
	4		33					
	5							
	6							
TOTAL B		**0**	**92**	**59**	**202**	**126**	**30**	**92**
C	1	131	106	106	165	180	162	216
	2	363	166	166	178	144	192	72
	3	53		90	50	36		36
	4							
	5			120				
	6							
TOTAL C		**547**	**272**	**482**	**393**	**360**	**354**	**324**
D	1					36	30	
	2		115	115	97	180	310	252
	3	239	378	248	475	288	156	324
	4	267	252	286	360	252		
	5			66				
	6							
TOTAL D		**506**	**745**	**715**	**932**	**756**	**496**	**576**
E	1	69	145	145		36	30	
	2		33	33			28	
	3	44	28	28	25	108	30	72
	4		33	132		108		
	5							
	6							
TOTAL E		**113**	**239**	**338**	**25**	**252**	**88**	**72**
F	1		33	33	40		60	
	2		33	33	40	18		36
	3							
	4		33			36		
	5							
	6							
TOTAL F		**0**	**99**	**66**	**80**	**54**	**60**	**36**
G	1				68	32	60	33
	2	120			70	24		12
	3							
	4							
	5							
	6							
TOTAL G		**0**	**0**	**0**	**0**	**0**	**0**	**0**
H		174	200	400	200			

Table III.2

Core Engineering Subjects and Engineering Specialisations		
	Contact hours	%
1st YEAR	117	14
2nd YEAR	288	36
3rd YEAR	613	77
4th YEAR	662	86
5th YEAR	373	80

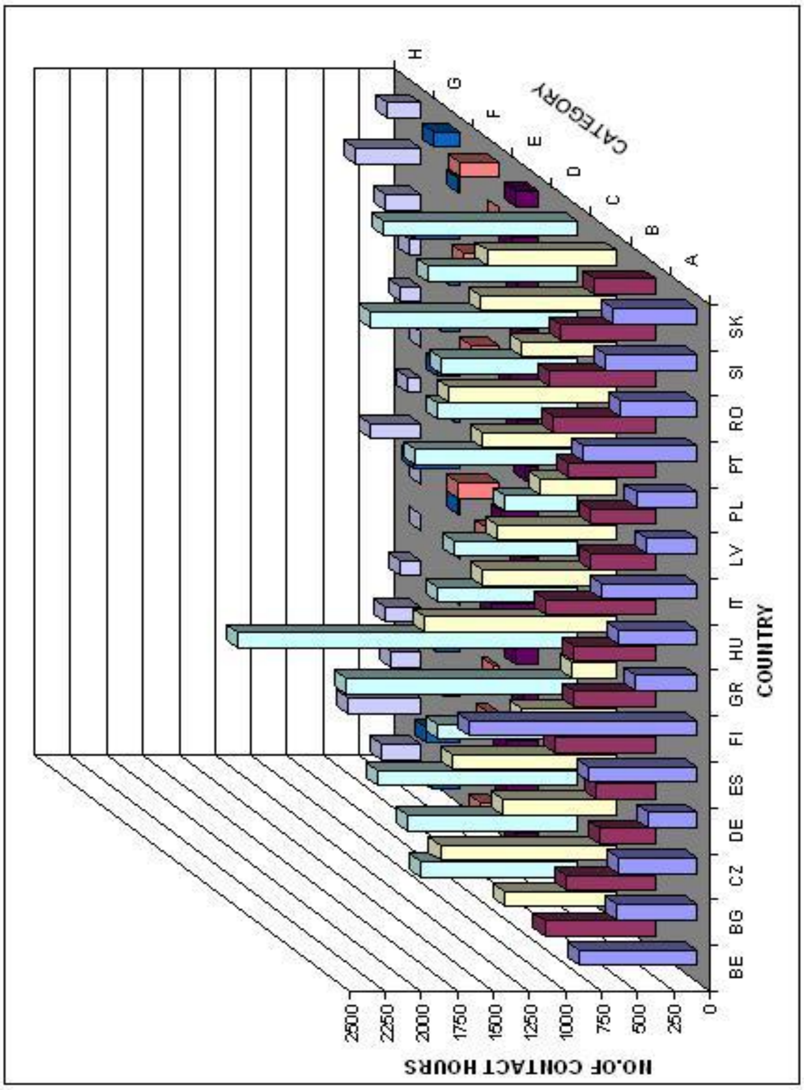


Figure III.24 Total number of contact hours versus categories in various countries (5-year programme)

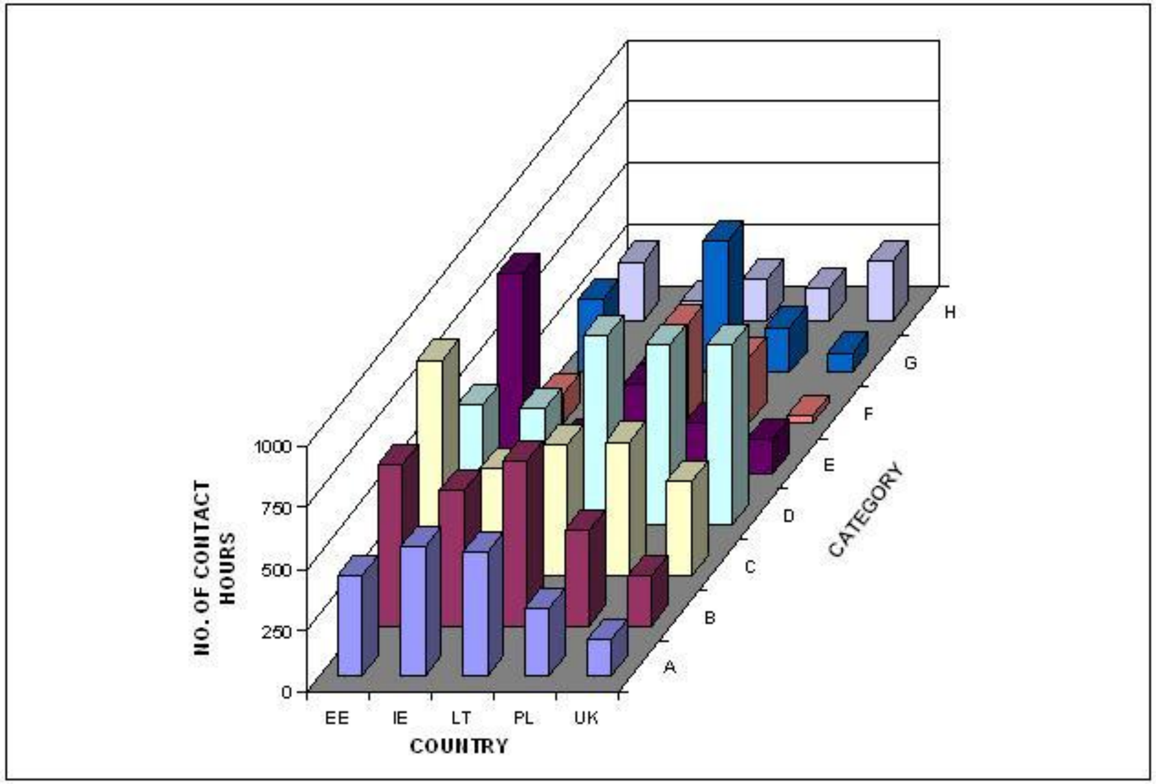


Figure III.25 Total number of contact hours versus categories in various countries (5-year programme)

PART THREE

REPORT OF THE **WORKING GROUP B**

Accreditation and Quality Assessment in Civil Engineering Education

Synthesis of Activities Undertaken by the Working Group B

Contribution to the Conception of an Accreditation Model for Engineering Courses

José Manuel FERREIRA LEMOS
University of Porto (PT)

Quality Management in Civil Engineering Education

Manfred FEDERAU
The Engineering College Odense (DK)
Alan KWAN
University of Wales Cardiff (UK)

Results of Survey on Quality Management in Civil Engineering Educational Institutions

Manfred FEDERAU
The Engineering College Odense (DK)

I SYNTHESIS OF ACTIVITIES UNDERTAKEN BY THE WORKING GROUP B

Preamble

This report constitutes a brief introduction and the main summary of the conclusions of the work of Working Group B of the EUCEET Thematic Project 55779-CP-1-98-1-ERAMUS-TN. The report should be read in conjunction with the following attached appendices. Each report represents work led by the attributed author(s) but the report is based on discussions, comments and finally the agreement of the whole working group:

[1] José Manuel Ferreira LEMOS, "Contribution to the Concept of An Accreditation Model for Engineering Courses", Oporto, Portugal, July 2000

[2] Manfred FEDERAU with co-author Alan KWAN, "Quality Management in Civil Engineering Education", Odense, Denmark, September 2000

[3] Manfred FEDERAU (Ed.), "Results of Survey on Quality Management in Civil Engineering Institutions", Odense, Denmark, September 2000.

The members of the group were:

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1. Introduction

After two Steering Committee meetings in Paris (Dec. 98 and Jan 99) TN EUCEET was launched at its first General Assembly of all partners in Barcelona at Universitat Politécnica de Catalunya (22-23 Feb. 99). The initial working brief from the Steering Committee for Working Group B was to examine the issue of "Quality Assessment and Mutual Recognition in Civil Engineering Education." Working Group B benefited from several active members of the Association of European Civil Engineering Faculties which had previously organised a symposium on Quality Assurance in Civil Engineering in Odense (May 97) and hence during the course of discussion in the first meeting in Barcelona, it was realised that the working brief from the Steering Committee was best approached from two distinct angles, namely that of accreditation, and of quality management, in Civil Engineering courses. The two interlinked sub-projects were thus initialised:

1 "Accreditation of Civil Engineering Education" coordinated by José Ferreira Lemos (Universidade de OPorto), and Alan Kwan (Cardiff University).

2 "Quality Management" coordinated by Manfred Federau (The Engineering College of Odense).

While the remit of the sub-projects is distinct, the working group resisted the temptation to work as two separate teams, in order to retain a coherence and unity of purpose. Common membership and joint meetings also helped to maintain integrity and prevented the two sub-projects from pursuing divergent paths. Over the working period, both sub-projects produced preliminary papers which formed the basis for the final papers presented in this report. In total, Working Group B met five times (Barcelona, Torino, Oporto, Odense and Prague) over seventeen months, but much of the work was conducted over e-mail and the internet (there was a working web-site) in the periods between meetings.

2. Project Aim and Working Method

Before the main conclusions of the Working Group are summarised, it is important that the project aim is explained further than the brief introductory remarks in the previous section have allowed. Foremost in the thinking of the Working Group on the brief set by the Steering Committee was the principle that mutual recognition leading to trans-national mobility of Civil Engineers and Civil Engineering students require an internationally agreed system that instils confidence in the standard or quality of the Civil Engineering education and training in a particular country. This is naturally dependent on two fundamental aspects of any given Civil Engineering course. Firstly, the course content (adequate spread across the Civil Engineering disciplines and adequate depth of study) has to surpass some prescribed minimum level and the process of ensuring this is accreditation. Secondly, even when the standard of the course content is set at a sufficiently high and broad level, there is still a need to ensure good quality of education delivery and this process is quality management. The two-pronged work of the Working Group follows naturally from such a consideration. In effect, the “Quality Assessment” brief from the Steering Committee has been sub-divided into the two processes that would ensure quality, *i.e.* accreditation and quality management.

The intention of the Working Group was to gather information on the extent and different practices of accreditation and quality management in Civil Engineering courses across Europe. Since accreditation is carried out by regulatory or governmental bodies, and thus uniform across a given country, while quality management is conducted at each individual institution (and possibly on a voluntary basis) comprehensive information on the former is not difficult to collate, while information on the latter can only, at best, be sampled. For this reason, a questionnaire on quality management was issued but data on accreditation was gathered from existing sources. Recommendations in the form of an accreditation model and a paper describing the features of a quality management system in Civil Engineering this form the two main publications from Working Group B. Results from the quality management survey, and the associated analytical commentary, are also presented.

In general, the overall picture is that accreditation and quality management of Civil Engineering courses across Europe occur only in a limited amount, and where they do occur, there are different approaches. The lack of a uniform, transparent and accountable system to guarantee minimum standards is clearly an obstacle to mutual recognition. It appears that there is no issue of principle against adopting accreditation and quality management. The basic difficulty lies in finding a common approach to the traditionally different education systems that different countries have to higher education (*e.g.* the length of degree courses). For this reason, it is envisaged that the quality management component of the Working Group’s output, which is implemented at the individual Civil Engineering department level, is likely to have a more immediate application. The lack of a national quality assurance body, or even an institutional quality management policy, does not inhibit an individual Civil Engineering department from implementing its own quality management regime. Nevertheless, the model on accreditation suggested in this report draws on practices current in several countries and should thus form a good starting point for countries contemplating adopting accreditation.

Some aspects of the two attached papers in the appendices require highlight in this main report before the conclusions are summarised. Quality assurance issues lead to measurement of process/product attributes against client/customer expectations. Such issues are not clearly defined in higher education. There are many interested parties (e.g. students, employers, the profession, the State, parents, etc.) and they do not fall neatly into any product/client category. Furthermore, the business of education involves, as input, students who normally have a diverse range of ability and commitment. A simplistic measure of graduates (output) is thus also highly inappropriate. In general, the Working Group has loosely adopted "education," or "the education experience" as the "product" and thus Working Group B is charged with work leading to the improvement of the quality of Civil Engineering *education*.

2.1 Accreditation

Clearly it is inappropriate for such a study as this to prescribe a narrow accreditation model which is then recommended to all countries for adoption (Working Group B has representatives from only a limited number of European states, and then mainly from academic institutions). The outline model presented is therefore likely to simultaneously look interventionistic and prescriptive to countries with no accreditation in place, while at the same time, somewhat imprecise for countries which already carry out accreditation; this dilemma is foreseen but inevitable and unavoidable. The details of the model are straightforward and require no further elaboration, but three issues should be highlighted.

2.1.1 The percentages for curricular content in Section 9.3 turned out to be one of the most discussed issue in the second EUCEET General Assembly (Odense, May 2000) and there are clearly different opinions across Europe on what the percentages should be.

2.1.2 The accreditation model does not prescribe the balance between general (basic) subjects and specialist (advanced) subjects. Different institutions/countries clearly have different historical traditions on this issue and for this reason, the report does not offer a precise number.

2.1.3 A similar question of balance of theoretical (e.g. scientific/mathematical) and technical (e.g. design/applicatory) subjects has also not been explicitly addressed for the same reason as given in 2.1.2

The lack of more detailed prescription emphasised in 2.1.1 to 2.1.3 does not mean that clearer definition of the numerical percentages and ratios are unimportant or impossible. In fact, there needs to be a clear European debate involving academic, professional and governmental representatives on these issues to facilitate a closer step towards mutual recognition. Members of Working Group B clearly do not provide an adequate forum for this discussion, but the Group draw attentions to the need for such a debate.

2.2 Quality management

A preliminary paper defining the features of a quality management system preceded the design and subsequent issue of a questionnaire to assess the extent of quality management in Civil Engineering institutions, or their aspirations for one. The preliminary paper thus served as an extended explanatory document to the questionnaire. It was an initial assumption of the Working Group that clear, transparent and detailed documentation of measurable goals and verifiable assessment procedures in Civil Engineering courses, and course units, is not widespread standard practice. The preliminary paper thus documented in some detail many aspects of a quality management system that would be regarded as standard by practitioners. Since the results of the survey endorsed this original assumption, and also a very high proportion of those who returned the questionnaire said they had found the preliminary paper helpful, much of the original paper has been retained for the final paper in this report.

It should be pointed out that a dutifully performed quality management by itself does not guarantee improvement of quality, it merely makes the level of quality (or the lack of it) more visible and quantifiable. An individual's or and institution's attitude to quality management can also determine the extent of its relevance. It is entirely possible, and indeed not very difficult, to design a quality management system that apparently shows consistently high level of quality. Despite this emphasis in the report, this important point is still sometimes overlooked and thus deserves special notice here.

It is important therefore that quality management is coupled with accreditation and this reinforces again the basis of the approach to quality assessment adopted by the Working Group.

3. Principal Conclusions

The accreditation model, together with a robust quality management system, should be understood as a suggested basis to help bring about a Europe-wide mutual recognition of civil engineers, and therefore free mobility of the professional. It is clear that mutual recognition is entirely dependent on all-round confidence of quality and both accreditation (providing a framework for control of the standard of the curriculum) and quality management (providing a framework for control of all aspects related to course delivery) are necessary.

A system for European mutual recognition of civil engineers would require an "index," or "catalogue", of approved courses which have all complied with an accepted accreditation model. The proposed model from Working Group B could be the working document for this index. It should be noted that just as civil engineering is a dynamic profession, and thus civil engineering courses are updated to be in line with new practices or technology, any accreditation model adopted by the index should also undergo periodic updating.

A European debate on a common accreditation model is likely to inspire fundamental debate on all aspects of curricula and thus likely to bring about an updating of old courses, and possibly inspiring new civil engineering courses. Such an overhaul should be welcomed by the profession.

A very beneficial side-effect of an education quality management system is the set of clear and accessible course, and course unit, documentation (e.g. on aims, objectives, etc.) which can then be used to aid trans-Europe student mobility, particularly if the documentation is accessible across internet and with translation to French or English.

Results from the survey showed that while only a small number of institutions had a quality management in place, many saw such a system to be useful and possibly inevitable for an educational establishment in the modern world. The Quality Management paper had been written with a European perspective and hence would be a useful starting point for institutions currently without quality management.

II CONTRIBUTION TO THE CONCEPTION OF AN ACCREDITATION MODEL FOR ENGINEERING COURSES

José Manuel FERREIRA LEMOS - University of Porto

Part 1

FACTORS WITH REGARD TO THE ACCREDITATION OF ENGINEERING COURSES

1. Introduction

Society has evolved in stages and not always peacefully. Since the beginning of the century, however, ongoing evolution has been recognised as a reality in all situations, with means of forecasting the future constantly being developed in an attempt to avoid surprises, which, even so, continue to occur. The capacity to accept the unexpected as the norm has led to companies making themselves more flexible in order to "correct their development" whenever necessary.

In line with the dynamics of progress, the increased knowledge required to effectively intervene in the professional field is of such importance that if an attitude of permanent modernisation is not adopted, the individual quickly loses the notion of reality. Moreover, the basis of education must include the dynamic setting and the acquired skills must guarantee a high degree of career flexibility.

This paper reflects the consolidated experience in the Accreditation of Engineering Courses, which has had an important impact on the improvement of higher education in engineering. The methodology was based on experiments known to be successful (ABET in the USA, and the UK Engineering Council), using quality principles and procedures after a careful analysis in order to adapt it to the country's culture and the participating institutions.

2. Engineering training

One of the most commonly cited definitions of engineering is provided by ABET (Accreditation Board for Engineering and Technology) of the USA. Since 1933, this board has been involved in the necessary characterisation of and training in engineering activities: "Engineering is the profession in which knowledge of mathematics and natural sciences, acquired through study, experimentation and practice, is appropriately applied to develop methods of economically using the materials and forces of nature to the benefit of mankind”.

Also, Portugal's Ordem dos Engenheiros defines engineering as “the application of different branches of science and technology (currently twelve: civil engineering, electrotechnical engineering, mechanical engineering, mining engineering, chemical engineering, naval engineering, geographical engineering, agronomic engineering, forestry engineering, metallurgical and material engineering, informatics engineering and environmental engineering) in activities research, design, study, planning, manufacturing, construction, production, inspection and quality control, including co-ordination and management of these and other related activities”.

Engineering presupposes, therefore, the conception, study, management or control of a product that may be technically designed, economically viable and socially useful, using the available resources: materials and natural phenomena. A degree in engineering is, therefore, a course based on the principles of mathematics and physics, with a pedagogical hierarchy (in sequence), broad curricular structure, (a broad spectrum profile) and adapted to the professional reality (encompassing business, environmental and social conditions).

The engineering culture is substantially different from purely scientific culture. The first must be close to "things" and is under significant time constraints for achieving results. Moreover, the costs of the product, system or situation under study constitute an extremely important factor. Scientific culture, on the other hand, is distant from the market and is relatively free of time restrictions in the undertaking of tasks and obtaining of results. It deals with products, systems or situations that are usually free of financial results.

Engineering also requires the capacity to comment on and criticise methods and processes, selecting solutions from the comparison of values, attributing judgements on the interest, suitability and rigour of approaches to problems, from a technical and scientifically demanding perspective.

In the majority of European countries there are two systems to train engineers - the university system and the polytechnic system. In some cases, such as in UK, the polytechnics were incorporated into the university system. This integration process had already taken place in Canada. The difference between the two systems lies essentially in a different approach to the material.

Given the ever constant need to strike a balance between theory and practice, the school’s guidelines for selecting the prerequisite education of a candidate to a technical career must be solely founded on its expectations and wishes. Individual characteristics should be given much more weight in selecting this education than titles, social image or even an abstract career idea. An individual motivated within an activity that suits him/her will be able to absorb recognition and social status in a manner far more relevant than merely through a title. Professional and financial success can be far more satisfying than a simple degree in a limited and closed context.

The clarification of higher education training for the acquisition of the skills needed for an engineering profession, together with the type of teaching that this encompasses, must be decided taking two aspects into account. High standards in the base courses and an educational background conducive to a rationale that is both broad and flexible and also appropriate for the engineering specialities.

The pedagogical structure must be characterised by a progressive linking of subjects, duly structured (clearly establishing the connection between the fundamental laws and principles and their application in solving problems) and consistently sustained (justified by the need to solve real engineering problems). Furthermore, it must cover many aspects (encompassing research, design, study, planning, manufacturing, construction, production, inspection and quality control, including the co-ordination and management of these and other related activities). This structure should be reflected in a system in which the subjects are taught gradually and in a somewhat rigid sequence.

In order to master the knowledge of a phenomenon, models have to be created – that is, systems that include cause-effect relations, which are sufficiently close to reality to achieve the intended aims. The building of an engineering model calls for the description of the phenomenon based on the core sciences: mathematics, physics, chemistry, geology, biology or others in accordance with the speciality under consideration, using language that is both theoretical and practical.

Specific engineering models are dealt with in courses called engineering sciences (fluid mechanics, material resistance, transport phenomena, etc.) and which aim to describe situations, still theoretical and with some degree of abstractness, but geared towards the intended applications using language that is both theoretical and practical.

The models that are closer to reality but separate from it need to be adjusted in accordance with the situations that they aim to interpret. Adjusting the phenomenon to reality is achieved through the speciality sciences, transmitted mainly through applied language.

3. Quality management in engineering education

Society has become continuously and persistently accustomed to demanding quality. This inevitably requires that needs and expectations be defined so that it may be assessed whether they are being met or not.

In accordance with a country's culture and background, quality has had two perspectives: the improvement factor and cultural evolution, which are either endogenous (true culture of quality) or an externally promoted factor (certification culture), but which is primary, incomplete and unstable. To benefit the education system, schools should implement a quality management system which clearly defines aspects affecting student learning so that the situation's evolution may be monitored whenever necessary.

We should not think that quality is merely a question of implementing a formal system of quality management. This is the first step, but it is far from the complete resolution of the problem. A school's quality management system can give some support to the improvements needed, as is stated by some United Kingdom universities, "the state of affairs is changing so fast that experience, intuition and pragmatism are the strongest aids for successful curricular restructuring."

Since everything applying resources involves costs to someone, quality is easily converted into a cost benefit analysis, whether to the consumer, company or society. Under these conditions, public or private institutions do not break from the rule and their reason of being, with obvious implications regarding their survival, is essentially linked to meeting expectations.

Schools teach, or put in another way, they train and inform. The components of training and information vary according to the level of education, the school's strategy and pedagogical goals. What weight should each level of teaching, whether basic, secondary, university or professional assign to each of these components? What is the training and information perspective that will enable progression of study in appropriate conditions for those who intend to undertake this education? What has been planned in terms of cultural and professional evolution of society for the upcoming years? Only by answering these questions can we speak about the education system's quality management.

The process of accreditation of engineering courses, where the system exists, recommends the adoption of a quality management system through schools that, supporting a clear policy, can show the kind of training offered to students. Due to their importance, other questions arise that are considered pertinent and are concerned with current concerns in some schools.

One of the most important aspects in launching any course is its strategic goals. They must be duly planned and their results published and periodically reassessed. The accreditation model should question some aspects such as the reason for including a given course in the school, the importance that the school gives to the course, the employment sector it is aimed at and the course's likely evolution. The desired answers must be provided in the application procedures and, especially, in visits when participation by management, teaching staff and students reveal whether positions are clearly assumed or are merely circumstantial intentions without a great deal of consistency.

We can say, in an analogy to the productive system, but paying attention to the fact that the school/student empathy does not fit into a pattern, that the client is the student/employer/professional association/society, the system is the pedagogical scheme adopted by the school and the assessment references are the demands established by the profession.

Laying out the aims with regard to the needs of the clients of an engineering school appears to be a simple task: the students are the "direct or first level clients," so to speak. But the normal student does not study simply because of his/her interest in studying; he/she expects to achieve a level of training recognised by employers and society and accepted by the respective professional association. Employees and professional associations constitute the "second level clients." The former group recruits technicians with training of recognised excellence. The latter group can, through the Accreditation System of Engineering Courses, share their main concerns with the schools about the quality of engineering teaching. But the chain does not end there. The state, due to the effect that teaching has on the country's economic and social development, also has responsibilities in controlling the situation. Society, through the state, is the "client at the third and final level."

The difficulty arises when an attempt is made to characterise the satisfaction of the expectations of each "client," level by level. The students have the capacity to assess the institution's pedagogical performance, the conditions of the installations and their greater or lesser identification with the aims proposed by the school. They are not usually able to make a scientific assessment of the course, the professional guidance that will be transmitted to them, nor the future influence of the learned culture.

We now move to "second-level clients." Employees usually prefer graduates who are able to immediately adapt to the functions for which they were recruited, who are familiar with the business environment and who have a pragmatic way of facing problems. Professional associations usually have another perspective, although not altogether different. They favour the flexibility that is defended in broad courses with less concern for a company's operations and more emphasis on the ability to adapt to different companies and different kinds of techniques. This approach favours strong training in basics as a means of promoting flexibility. In addition to this, it is important to the professional association that engineers constitute a well-defined professional class, thus avoiding dubious situations where they incorporate skills of other professions.

The "third level client" is the state. Although recognising that professional associations are more suited to resolving problems than the state, the government frequently intervenes in academic courses, professional profiles, definition of vacancies, compliance of training with EU rules for which it is responsible, these being aspects preventing an analysis from a business perspective. Even in private schools the state intervenes, sometimes directly.

Inefficiency surveys are also extremely specific. In a relation in which the state almost always controlled financially and where there are already many background factors, especially regarding other public-sector workers whose stranglehold cannot be broken without intense labour conflicts, inefficiency has to be treated with a great deal of care. Activities that do not bring an immediate return on costs – as is the case with most research activities – have to be considered in this context, and the use which the state makes of resources at its disposal may adulterate any business perspective of higher education in engineering in public schools.

Despite everything, it remains possible to identify the more favourable enrolment conditions that will allow the best and most suitable students to be selected, thus reducing cases of failure. The pedagogical assessment questionnaires filled in by students can help to clarify many problems. The monitoring of graduates, to a certain extent, boost the school's prestige in professional circles.

However, that which appears to be the most important point, but certainly also the most difficult for a school, even if there was a clearly defined economic strategy at a centralised level, is to predict how the market will evolve. This involves forecasting what will change on the business level and on a professional level, the main technological advances (the majority of which are unpredictable) and the shifting of industries and markets owing to worldwide strategic and political alterations. After a profound reflection on the probable alternatives, a teaching strategy must be defined that is suitable for the future. It is within this aspect where most difficulties are noted by those who follow-up the administration of engineering schools. The creation of courses and curricular adjustments are often carried out superficially.

Quality must be assessed through the quantifying of parameters without which no evolutionary analysis is possible. In order for the assessors to obtain a real notion of the evolution of the course quality from the perspective of conformity to the adopted model, it becomes necessary to maintain a record with the gathered information duly filed, so that it can be consulted whenever a renovation takes place.

In order to compile this data the school needs to take on this task, which leads to the importance of assembling a data collection and information handling system. The records should be accessible to all who require them. Nevertheless, procedures should be implemented to deal with situations in which confidentiality imposes limitations.

In engineering schools, the internal regulations are usually published, informing the teaching staff and the students of the institution's rules, the application conditions, teacher promotion and the conditions for entrance and progress of student candidates and current students. The existence of this document, an real general-use manual, becomes fundamental for those interested in applying to the school, those attending it or those teaching in it.

The school's organisation depends on the perspective of its management bodies. The creating of an informatics system to aid management, the drawing up of administrative procedures and their publication, the creation of an effective internal information system, the publicising of the school's offer and the creation of support structures for the recruitment of research projects abroad, namely in industry, can be achieved by any school. These measures should be complemented by the creation of a pedagogical training system for teachers, the maintenance of a prestigious image in the market and the constitution of a structure facing the problems concerning improvement in teaching quality.

The leadership of an institution is one of the keys to its success. It is people who build the image of institutions and who, through their enterprise, motivate teams. And it is the teams, with their effort, their competence and creativity that will enable expectations to be satisfied both of the institution's integral components and/or clients.

This issue is extremely complex when analysed in the context of universities because the culture transferred from a recent past to the chairmanships was hermetically structured where only the head gave opinions and decided. As a result of this situation, what was taught was not that which was of interest to the training of the students, but what a given individual had decided was of interest to him. This culture also impeded the effective co-ordination of the institution as a whole. With some difficulty but with relative success, the university culture has been altered and for some schools the opinions expressed by the accreditation juries have been well accepted in countries where these systems were implemented.

4. Accreditation and evaluation

There are at this moment different assessment processes for higher education schools in different countries throughout the world. Some are promoted by professional institutions (in the USA), others to a large degree by state institutions (the majority of European countries) and others where the two systems exist side by side (UK, Ireland and Portugal).

These processes are different; evaluation by the state is geared more towards the pedagogical and scientific aspect and accreditation (professional) geared more towards the skills acquired by the graduates. As accreditation is based on the appropriateness in terms of engineering, the curricular assessment of both the teaching staff and the students is grounded on this analysis. The assessment system with a preferential academic perspective has more difficulty in encompassing the professional aspect.

Professional assessment must concentrate on skills and, above all on performance; the pedagogical and scientific assessment, under guardianship of the state, must above all focus on aspects more linked to potential, pedagogical functions and the effectiveness of the institution as a whole.

The assessment process with its academic perspective and the accreditation process with its professional perspective differ in their formal aspect in two important ways. In the case of the former, the analysis must be complete – that is, take into account all of the activity developed at the school level, whereas the in case of the latter the environment is usually more restricted. Assessment often has few consequences, while accreditation has immediate consequences in professional terms.

We can assess the training of engineers in three aspects: assessment of potential, of skills and of performance. Professional assessment must be centred on the skills and, above all on performance. Pedagogical and scientific assessment, energised through state administration, must above all focus on aspects rooted in potential, pedagogical functioning and the effectiveness of the institution as a whole.

In a situation in which the job market in Europe causes young graduates so much concern, in which the entrance conditions to higher education reflect the difficult attempt to make mass education and quality teaching compatible, the reformulation of engineering teaching is a Herculean task.

In addition to the professional consequences, the accreditation process usually makes an important contribution to the improvement of the professional preparation of engineers. It ensures the necessary articulation of knowledge between the higher education establishments and the needs of those professionals destined for undertakings in the highest realms of engineering. There are many aspects that can condition the construction of the accreditation model to be adopted:

- Size of the job market
- Industrial culture
- Social impact of the profession
- Technological and industrial advancement of the country
- Economic integration
- Business support for the accreditation system
- Internal lobbies in favour of and against accreditation
- Tradition and character of the population
- Compulsory schooling to be completed
- Responsibility of the education system in assuming a partnership
- Strategic interest of the country with regard to questions of education and culture
- Employment flexibility within the profession
- Interest in the profession
- Tradition of the institutions
- Availability of assessors
- Tradition and credibility of accreditation
- Availability of statistical data
- Institutional and social organisation
- Authority and prestige of the Minister of Education (authority)
- Etc.

Therefore it is easy to understand why the accreditation model is different from country to country, from culture to culture.

The methodology built for the accreditation of engineering courses, although specific for the aim that it intends to achieve, must have an approach grounded on the principles of that which is currently defined as quality. Quality in this context corresponds to improving the skills of graduates through schools, on the one hand and improving the effectiveness of schools at the cost of rationalisation of the available resources on the other.

The accreditation system must be based on the methodologies of quality for three main reasons. First because the generic model of quality has already existed for a long time and is consolidated in terms of general acceptance. Second because this perspective, being well known, facilitates the protagonists in understanding the approach taken up, whether they be representatives of professional bodies or the schools. Finally, the experience acquired in applying quality methodologies enables, without great difficulty, parallels to be established between situations that occur during the procedural implementation of the accreditation processes and other situations verified in the context of companies and other institutions. This in turn enables decisions to be taken in dubious cases, in a more grounded manner.

The basic principle of quality, as it is understood today, is the concern to satisfy the needs of clients/users. The aim of Accreditation of Engineering Courses consists of assessing to what extent the course provides suitable training for exercising the profession. The quality of the accreditation process is therefore dependent on its suitability for the aim for which it was created.

Another fundamental aspect for the credibility of any assessment lies in the fact that it is undertaken formally, in an objective manner. The functioning of the process must be supported by clear procedures with well-defined responsibilities at all levels of the hierarchy and accessible to all those interested.

In the perspective of quality, improvement is always possible because the analysis of inefficiency is never complete and because means improve constantly. Given that the perspective of quality is all-encompassing and its utilisation is increasingly generalised, all institutions with common concerns, by mutually supporting it, will help bring about these improvements. Precisely for this reason, the accreditation system must be periodically revised and updated. This necessity arises from the natural evolution of all systems and the need for their appropriateness for an ever-changing reality.

4. Creation of an accreditation model

The model for accreditation of courses must contribute to some aspects of the school's leadership. Here, the state and the regulations have an important role to play, although it is not easy to carry through alterations that break already-acquired status.

Any non-quantified assessment is incomplete and imprecise. The undertaking of tests constitute one of the basic aspects of the assessment of both the students and the quality of the pedagogical tools used. The double assessment (system/student) must allow testing, in an effective manner, and the real skills acquired by the trainees, and must be adjusted to the population that is to be assessed.

Carrying out an exam must not be a juxtaposition of questions. A structure must be in place that enables the assessment of the extent to which the pedagogical aims have or have not been achieved, not only on the part of the student but also with regard to the teaching system itself. If the student does not learn, questions should be asked about the school's recruitment and teaching methods.

The duration of the test should be related to the difficulty of the questions and the effort demanded from those being examined. The reliability of the assessment given by the test must be coherent with the results given by any other assessment means. Hence, a suitable degree of difficulty (related to the average of the distribution of marks), discrimination of questions (capacity to distinguish the levels of knowledge of the students assessed with the standard deviation of the distribution of marks) and a high level of objectiveness in the classification (achieved through a detailed key of the possible solutions) must be maintained.

It must be possible to clearly identify in the engineering courses the alternatives, options, precedents and prescriptions, the calculation algorithm of the final course grade, the definition of objectives of each module and its content, the definition of the existing pedagogical means and the manner in which they are managed.

The registration records, success rates, costs per student, activity reports and list of research projects are important data to assess an institution's performance. The treatment and release of such data must be perfectly clear for all of its users, treated with recourse to statistical or other techniques for monitoring the situation.

The training posts must be assessed with regard to their duration, goals and pedagogical and professional suitability.

Particular attention must also be afforded by the jury to the existence of a "School Spirit," duly consolidated as a basis of the engineering courses. This is manifested by the attribution of equivalence for transfer between schools with the necessary precautions, the existence of a stable and effective teaching staff, a teaching policy adhered to by all and a permanent concern for pedagogical improvement.

Performance assessment, however, takes place outside the school walls. The performance of the graduates is only stabilised after approximately five years of professional activity and, at the end of this time, the state of affairs will have changed so much that it would be inappropriate to use the results of this observation to adjust the preparation of the next generation.

If we add the five years of professional activity needed to acquire maturity to the years of course attendance and the time required in order to carry through the desired adjustments, we have a total in excess of ten years. Using information collected on the teaching process that started ten years ago in order to make adjustments that will only have effects five years down the road (the time when the graduates affected by the adjustment will come onto the job market) makes this type of assessment impractical given the speed with which the professional context alters.

A closer relation between those who are in the "field" and know the realities of exercising the profession and those who conceive the courses is of fundamental importance.

6. State of the "Art"

The first declaration about accreditation of engineering programmes was presented by the Engineer's Council for Professional Development (ECPD), the predecessor of ABET (Accreditation Board for Engineering and Technology), to the Committee on Engineering Schools in 1933. An initial declaration, although somewhat altered, has been the basis for accreditation until the year 2000. From 2000 onwards, the "Engineering Criteria 2000" will be in force.

ABET is currently the only body recognised in the USA for accreditation of educational programmes that lead to higher education in engineering and technology. This culture, started in the USA, is the oldest of its type in the world, and ABET's experience has been applied by many other countries, especially Portugal, to build their own accreditation systems.

According to ABET the goals of accreditation are:

(1) to guarantee that graduates from an accredited course are suitably prepared to begin and progress in the practice of engineering
(2) to stimulate improvement in the engineering teaching system
(3) to encourage innovative approaches to engineering teaching
(4) to inform the public about these programmes

Based on mutual interest of professional recognition, the "Washington Accord" was signed by Australia, Canada, the United States, Ireland, New Zealand and the United Kingdom. In 1993, South Africa signed up followed by Hong Kong in 1995.

In addition to the 4 academic years of higher education at an engineering institute, the following is required for mutual recognition of the accreditation covered by this accord: specific course requirements (mathematics and other basic sciences, engineering and complementary themes); pre-established visit procedures; and general criteria applicable to engineering programmes as a whole, corresponding to a full 6-year accreditation.

Some countries such as Portugal, the United Kingdom and Ireland have a twin assessment system. One is managed by the state and focused more on scientific and pedagogical questions. The other is geared more towards the professional perspective and administered by professional associations. The two systems are completely independent although there is some communication between them.

In most countries preparing to start assessing their higher education courses, this process is being carried out in most cases under state supervision, or at least with state participation. This is the case in India, Japan (although also with participation from professional associations), Colombia and Argentina. In Europe we can add the following to the aforementioned cases:

In the United Kingdom the “Standard Routes to Registration - SARTOR” constitutes a number of important rules issued by the "Engineering Council," for the accreditation of courses;

In Belgium some institutions have begun self-assessment procedures and have submitted themselves to external inter-pair assessment processes;

In Denmark, the Minister of Education is the official responsible for quality assessment of the teaching programmes through assessment centres;

In France there is a “Comité National d’Evaluation,” directly dependent on the Ministry of Education, whose duty is to proceed with the accreditation of courses and their renewal every four years. The minister also has as an auxiliary body, the “Comission des Titres d’Ingénieur” whose main concern is to safeguard training and to defend the title of engineer, certifying schools for maximum teaching period of six years before renewal;

In Germany some schools are developing their own assessment system with support from the Permanent Conference of Rectors;

In Iceland, engineering training was assessed in the late 80s, sponsored by the “Association of Chartered Engineers in Iceland.” In 1993, an ABET Commission assessed the engineering teaching system by request of several ministers, the universities and the Professional Association of Engineers;

In Holland there is an institution: the “Association of Co-operation of Dutch Universities” (VSNU) that from 1989 onwards defined the procedures for assessing universities. A study of programmes was also undertaken with participation from ABET, upon request by the Minister of Education and Science;

In Sweden, regular assessment takes place on a national level, as an initiative of the schools that organising periodic meetings themselves;

In Switzerland there is a Centralised Commission of Industry to examine reforms carried out by schools.

Throughout 1995, some areas of engineering on a European level were also assessed, as part of the "Higher Education Assessment" programme.

The study and application of mathematics in physics, chemistry and biological models and the study and systematisation of methodologies for approaching specific concrete problems is a common manner of providing training to post-graduates. This deepens their knowledge of the essential tools for exercising the engineering profession.

It is also fundamental for the engineer to maintain the capacity to reason in a logical and structured manner, characterising presuppositions, establishing steps, arriving at scientifically and technically grounded conclusions and critically assessing the results.

The detail covered in the classroom depends on the pedagogical quality of the instruction and the students' capacity to assimilate this material. The material given in traditional and more prestigious courses can be a reference for laying out the recommended detail for tackling different themes.

Teacher involvement in activities outside school is a way of helping them to understand today's professional realities, something that the university environment does not always allow to be clearly seen. The teacher is not compelled to be a practising engineer but he/she must have a firm grasp of this reality.

Within the new systems of work organisation, quality management becomes relevant not only as the main guiding principle within the institution, but also as a catalyst to ensure the vitality of an internal process of continuous improvement without which no institution can hope to provide a service appropriate for the needs of its users.

The decision concerning the request for accreditation of an engineering course is influenced by the scope and depth of the courses, which must match expectations created by the course's structure.

The problem of constant updating will be the great future challenge in which collaboration with pedagogical and scientific institutions will bring together specialists from different areas.

7. Current trends in course accreditation

In the USA, ABET has already began to revise its system (its 1994 version was the basis for the system adopted by the "Ordem dos Engenheiros" in Portugal), so that the assessment may rely more on results rather than processes. This induces career versatility within the global market context, where the movement of people is constant and the study of human sciences is an indispensable tool.

The "Engineering Criteria 2000," that embodies this evolution clearly forecasts of an alteration of the state of affairs that has developed in professional engineering: the replacement of the Taylorian model and the concern for ensuring a flexible standpoint.

This document was first published in January 1998 for a phased three-year implementation to start in 1998-99. Throughout these three years (1998-99 to 2000-01) institutions can opt for programme assessment by "Engineering Criteria 2000." As soon as the school selects these criteria, all of the courses must be revised under the same perspective.

The base criteria for accreditation according to “Engineering Criteria 2000” encompass the following eight points:

Criterion 1 - The quality and performance of the students and graduates.

Criterion 2 - The educational goals of the programme that should be explicit and comply with the regulations and also periodically reassessed. The curriculum must ensure these goals are met by a continuous assessment confirming this to be the case.

Criterion 3 - Acquisition of skills and their assessment with regard to mathematics, engineering sciences and planning, showing the capacity to formulate and resolve problems mastering modern techniques, communicating efficiently and working in multi-disciplinary teams, demonstrating knowledge of professional work ethics.

Criterion 4 - The suitability of different areas that make up the course, especially an appropriate level of mathematics, engineering sciences and complementary sciences.

Criterion 5 - The quality and number of teaching staff, together with the teacher-student interaction levels.

Criterion 6 - Quality and suitability of pedagogical facilities and the learning atmosphere.

Criterion 7 - Institutional support and the institution’s financial resources.

Criterion 8 – Compliance with the requirements specified in the "Programme Criteria."

The document ends by recommending that a professional component be included in the course.

The teaching has to enable each student to realise his/her potential in a perspective not merely of survival but also of providing the basis for the maximum possible success.

The emphasis on motivation and leadership training, in this context, is an important factor given that the engineer achieves results fundamentally with the collaboration of others.

There are important aspects that recommend some prudence in the adoption of "front line" systems, especially in Anglo-Saxon countries. Firstly, the objectivity with which these countries face any task and their natural independence from social influences or pressures allow greater simplification of applicable rules. Secondly, the knowledge accumulated as an experienced body of assessors grants the system sufficient credibility. The less experienced countries require more detailed regulation systems.

The selection of assessors is given great relevance and publicity in the USA, where there are about 770 assessors for a total of 1,450 accredited engineering courses that are periodically reassessed. All of these assessors need to have 20 years of industrial or academic experience, must be registered in a professional engineering association in at least one state of the USA, have professional involvement on a national level, have taken part in ABET training sessions for assessors and have participated in visits as observers.

As with everything linked to human endeavour, the concept of accreditation is also in constant evolution. In Portugal the "Ordem dos Engenheiros" launched its system nearly six years ago and is awaiting the outcome of their criteria applied in the teaching of engineering. Up until now the indications have been encouraging and the professional body itself has taken up a flexible stance provided that the base sciences and engineering sciences are sufficiently strong. On their own initiative they have publicly presented the criteria in assessment programmes of higher education courses to obtain participants’ opinions about the current system. It has promoted an internal debate about the profile of engineering facets to be continued until a permanent judgement is reached on this matter. It maintains a contact group between the "Ordem dos Engenheiros" and the Board of Portuguese University Rectors in which each of the participants informs his/her respective institution about the discussions that took place in the meetings held by this group.

Finally, some results have already been released through documents arising from the acquired experience. Dialogue with schools has essentially been about development of the process, and its maintenance is essential in order to enable it to adapt more and more to the goals of its implementation.

Part 2

CONTRIBUTION TO THE CONSTRUCTION OF A MODEL

8. Proposal basis for an accreditation model

8.1. Principles

The course accreditation process will be carried out based on the following presuppositions:

- The school applying for course accreditation meets the generic conditions of an engineering course, has a curricular programme, teaching staff and academic activity appropriate for the training of engineering professionals to a suitable technical and scientific level.
- Course accreditation will be granted when the technical and scientific conditions for the professional training of technicians to a minimum level have been confirmed.

Accreditation must begin with the preparation of dossiers by the institution, with a dossier of general information about the institution and the common subjects, and dossiers for each course to be assessed.

The request will be made in writing, signed by the director or other equivalent official of the school. This letter must include three copies of course dossiers and be forwarded for each course accreditation request, as well as three copies of the institution's dossier.

8.2. Procedures

There must be two documents for the accreditation process: one guideline document to be sent to the schools and a manual with questions for the jury. Any of the documents must outline, in addition to the system's philosophy, the elements that make up the application dossier, the procedural processes until the final decision and the main aspects that may condition the accreditation. These documents must be reviewed and progressively improved taking into account the experience acquired in the ongoing accreditation actions.

The jury will study the elements submitted by the institution and arrange and prepare visits to the various institutions whose courses are to be assessed.

A visit to the facilities should be agreed between the jury and the school. Arrangements must be made in advance with the School Board or its representative to decide on the persons to be interviewed from members of the School Board, Scientific or Pedagogical Department, other course professors or assistants and graduates or recent graduates, in addition to other people whose relevance becomes apparent during the course of the visit.

At the end of the visit a report is prepared, the factual aspects of which are to be verified by the school. Finally the jury will deliberate and submit its decision. The jury report will not be published - only the decision on whether to grant accreditation and its validity period will be made public.

8.3. Content of the dossiers

The Course Dossier must in particular contain the following information:

- Institution's file (general data about the management bodies, number of students, budget, courses given and postal address, telephone and fax numbers),
- Presentation text (information about the institution's teaching evolution, including the founding date and the institution's names throughout its history, characteristics of the school facilities, location and its suitability for the teaching activity, criteria and conditions regarding transfer from other schools),
- R&D and rendering of services (indication of contacts and collaboration in technical-scientific activities and rendering of services for national and international bodies),
- General data (general information about the teaching staff, number of course hours and attendance),

- Presentation text of the course, with reasons behind its creation and its current aim,
- Course plan (organisation of the course, subject options plan, equivalence and specialisation),
- Teaching policy and chart of the course's pedagogical activities, advice (text describing the policy of teacher monitoring and support of student curricular progress),
- Data about the training, means and habits of the students in scientific and technical information,
- List of teachers, (list of the school teaching personnel of the School for the specific course subjects with indication of their qualifications and numbers of teaching years at the school),
- Teacher files (brief curriculum of teachers of the specific course subjects),
- Course files, (programmed content of the specific subjects with their respective number of hours, main books and other support elements used in the preparation and work in lessons, fundamental bibliography, assessment methods; in each case two examples of recent exams should be enclosed),
- Laboratory descriptions (characterisation of the equipment and laboratory infrastructures, workshops or computer rooms used in the specific subjects)

8.4. Visit to the school facilities

The aim of the school visit is to verify the situation on location, to clarify the points in doubt, to assess the characteristics of the support facilities, especially laboratories and libraries, to gather the opinions and motivation of teachers and students, etc.. Furthermore, efforts will be made to evaluate the collected information's objectivity and conformity with reality, to check that there are sufficient personnel and that they are appropriately qualified and to inspect the students' work.

The visit will take place over one or two working days and will give rise to a report where the compliance or non-compliance with the elements contained in the dossiers as well as other elements considered important will be corroborated. A general judgement of the course will be outlined, with reference made to strong and weak points and, if this proves to be the case, aspects deemed unsatisfactory.

The visit report will be presented to the school before final discussion in order to correct possible lapses. Next, it will be completed by applying the laid out criteria, recommendations and indication of the validity period of the accreditation or its rejection.

The visit to the school is therefore an essential element of the jury's decision. All interested parties should face it in an open manner. The visit should also allow the character of the intellectual environment and motivation of the teaching and student body to be defined, together with its potential, capacity, competence and other aspects difficult to forecast.

9. A proposal for the terms of reference

The following terms of reference are proposed, which were drawn up with the aid of documentation from ABET of the USA, the Engineering Council of the UK and the Portuguese "Ordem dos Engenheiros."

9.1. School administration

The image of the school and of its administration as seen by organisations linked to education and by public opinion are important assessment indicators. Usually this image is the fruit of persevering and persistent work given the fundamentally cultural character of higher education schools.

This image is formed with the contribution and opinion of all those that in some way have dealt with or collaborated with the institution: ex-students, ex-professors, bodies of a scientific and/or pedagogical nature which, in some way, came into close contact with the school. Also the current students, teachers and other employees obviously constitute an important factor in forming the image.

The kind of management that is exercised at the school, especially the policy of openness and participation by which leadership is brought to bear strongly and contributes to the creation of its image. Rigidly centralised and autocratic models are totally rejected by modern society and limit the motivation and co-operation between the members of organisations and, consequently, the efficiency of services that are offered.

Given the teaching institutions' necessity to adapt to a world that is undergoing increasingly faster and more profound changes, schools that do not have the capacity to adapt based on an openness to new ideas and a flexibility to change will quickly become outdated.

9.2. Teaching staff

One of the key factors effecting the quality of teaching is the teaching body. Covering the different subjects with appropriately prepared and motivated personnel is a fundamental condition to successfully prepare new professionals.

The participation of qualified scientists and technicians, with real experience in teaching, in industry, in consultancy or in investigation is an important aspect to consider. Pedagogical, effective and motivating innovation is a factor that must be highlighted. The communication environment and atmosphere created in the school will be an important vehicle to stimulate learning.

The following conditions should be apparent with regard to the teaching staff:

a) Appropriate base preparation and teaching experience;
b) Non-academic experience in the field of engineering;
c) Facility in communicating in the mother tongue and in two alternative languages;
d) Interest in new pedagogical methods and in involvement in the students' school and non-school activities;

It is recommended that the course teachers also satisfy the following conditions in general:

a) Coverage of all teaching hours specified in the course programme with duly qualified teaching staff;
b) Full-time teachers, including a degree co-ordinator, working exclusively for the school;
c) A minimum number of PhD holders teaching full-time in the specialised subjects;
d) A minimum number of teachers exercising professional activities or with extensive professional experience, members of the National Association of Engineers.

Teachers' curricula must be evaluated in consideration of the material they teach and course goals. A curriculum, in addition to its own merit, must be suitable for the given post.

Pedagogical aspects must be prized, together with scientific aspects and professional involvement of teachers. The assessment of the school teaching body is to be undertaken as a whole and should favour a balanced distribution and diversification of skills and experience and guarantee coverage of the principle aspects of day-to-day academic life. This includes planning, organisation and management of available resources.

Factors to be assessed include the registration of teaching body members in scientific and technical societies and associations, publication of technical and scientific articles in specialised journals and documents and papers given at conferences.

9.3. Curricular content

The curricular content must be appropriate both in scope and in depth. It is important to analyse the perspective in which the material is handled and the guidance given for applying knowledge and practising the profession.

The material to be taught must provide students with a solid base, with special emphasis on the fundamental scientific themes, on engineering sciences, on speciality subjects, on the study of practical cases of modern civil engineering, on the undertaking of practical and experimental projects and planning requiring the integration of different subjects learned, on the training of oral and written communication and on the development of the capacity to co-operate with professionals of other specialities and professions.

The following aspects should valued:

a). Dedicated attention to problem formalisation and resolution;
b). Awareness of social and ethical problems related to the engineering profession;
c). The sense of responsibility of the engineer with regard to problems of safety, health and the environment;
d). Consideration of engineering development within the context of the European Union;
e). Concern for permanent training.

The analysis must be carried out subject by subject, summarily in the less relevant ones and more in depth in those that are more important. It must quantify each subject's hour load and assess how it is approached, namely with regard to depth and scope. The theoretical components, theoretical-practical, practical and projects help to characterise the type of teaching.

Compliance of course's profile with the characteristics of a particular engineering branch must be assessed through the material taught in the course's base subjects and core subjects.

It is recommended that the following conditions be satisfied for granting of accreditation:

a). Adjustment to the profile of an engineering course;
b). Compliance with the profession's social and ethical perspective;
c). Suitability of the course to the needs and interests of society.

In a world where ongoing training increasingly occupies the futures of graduates and their careers, it is important to guarantee, above all, a solid base formation. As such the following weighting distribution is recommended for the different course subjects:

	Recommended
Base Sciences	20%-30%
Engineering Sciences	20% - 30%
Speciality Sciences of Civil Engineering	30% - 50%
Complementary Sciences	5%-15%

Base sciences are defined as subjects that provide the basic scientific training (e.g. mathematics, physics, chemistry). Engineering sciences are the subjects that deal with the applications of the base sciences and general models (e.g. elasticity theory, resistance of materials, science of materials, fluid mechanics, geotechnica, technical drawing, etc). Speciality subjects are those that deal with the direct application of the materials in the resolution of real engineering problems, constituting the final link of the subject matter (e.g. reinforced concrete, foundations, applied hydraulics, metallic constructions, etc.). Complementary subjects, although essential, do not fall within the speciality's main scientific line of (e.g. sociology, economics, management, programming and utilisation of informatics resources, languages, the environment, industrial safety, etc).

The final individual work or group projects of randomly selected students must be assessed. Actions stimulating and motivating the school should be encouraged to perfect the technical-professional ability of the teachers, along with actions involving the students such as projects in co-operation with companies and other external bodies, debates and seminars, study visits and training when related with the course, etc.

It is also important that the course structure be suitable within a social and ethical perspective with regard to the exercising of the profession and its suitability to the needs of society.

The material's level of difficulty must be assessed through the exam papers of examinations already given.

Future engineers should be made aware of the real world through experimental work in laboratories and current works, contact with integrated problems that should also be briefly tackled in the subjects of conception and design, demonstrating real situations in field trips. Placement training and study visits and attendance at seminars with the participation of external bodies make up the set of approaches that are recommended for training in engineering, possibly complemented by an introduction to applied research.

As complementary aspects, but also essential for knowledge of the context in which professional work takes place, we can refer to training in quality and control of products and services - including tools to manage clients in order to guarantee the suitability of the production and services catering to the needs for which they were requested. In addition, cost management and profit/loss analysis (for decision making support), economics (to understand the mechanisms of the market to which the production is directed), behavioural analysis and leadership (to support sound working relations in management positions or in teams) should be touched upon in the course.

To successfully undertake their profession, civil engineers should also have notions of work sociology and labour legislation to know their duties and rights within the hierarchy. He/she should also have an idea of professional ethics and deontology in order to be able to adapt his/her conduct in a professional environment.

Post-graduate training, which today is a crucial requirement in the engineering field in order to ensure the professional is up to date, enables potentials to be maintenance so that engineer's may user their capacities to the full. In the training of the engineer these aspects have to be highlighted in order to create a permanent concern for continuous training.

9.4. School enrolment and assessment of students

To ensure a good level of education, it is important to maintain good enrolment qualification standards for higher education, and the authorities must be pressured into providing the conditions to achieve this. Mass education, which has become a reality in recent years, makes the question of entrance qualifications more complex but also more critical. As such:

It is recommended that for accreditation of a given course, that there be selection criteria guaranteeing a minimum level of education for entrance into an engineering course, especially with regard to mathematics, physics and languages.

Analysis of exam results and entrance averages are means of assessing the effectiveness of selection.

It is recommended that there be a system to follow-up the individual path of each student or to offer pedagogical and career advice for counselling in the options chosen throughout the duration of the course.

9.5. Course structure

Given that higher education renders a training service to society at the highest level, it is fundamental that its goals be known. The course is not justifiable in its own right; it must be structured to suit the needs of the country and of professional careers in order not to frustrate the future expectations of those who have enrolled.

We may identify the course's socio-professional role by analysing, its goals, its place in the job market and the strategy for defining the range of options. The course's acceptance in the market may be determined by a historical survey of its evolving demand. All of these aspects must be subject to an objective assessment given the importance of their impact on the students' expectations.

The course's structure must be compatible with its goals. The course's range of options, taking into account the aims of each particular one, is an element of great importance.

The overall timetable indicating the type of activities planned, the content of investigation and research by teachers and students, the professional practice exercised in internships, and the planning of extra-curricular activities are also relevant aspects.

Taking into account that technologies are nowadays changing at an extremely fast rate, leading to strong knowledge-updating demands, it is fundamental that the school have resources to remain abreast of the most modern techniques.

It is recommended that the lack of up-to-date technical and scientific knowledge and mechanisms to maintain this knowledge up to date is reason enough to reject a course's accreditation.

Maintaining external contacts with the main research and development centres where the most important technological advances are achieved, together with the subscription of specialised journals and publications, constitute very important aspects that must be unceasing.

It is also necessary to ensure that the knowledge is suitably assimilated.

9.6. Research and development

Schools, through their activity, concerns and cultural prestige, constitute bodies with a predisposition for research and development activities. It is very important that the school have at its disposal resources that enable research activities, whose virtues are demonstrated with regard to the organisation of reasoning, the compartmentalising of ideas, the desire to surpass what is already known and ability to accept new challenges.

The bibliography and available equipment play an extremely important role here. Concerns of this type can help to consolidate the notion of an advance in ideas and methods, whose beneficial consequences will certainly reflect on the quality of teaching and that will have a favourable effect on the jury's assessment.

The list of subscribed journals, together with the analysis of criteria that led to their selection and the laboratory equipment available and in working conditions, its usage and the work in progress should be the basis of the assessment criteria of these aspects.

9.7. Facilities and resources

Good teaching quality depends on the facilities, their size and degree of comfort. Their cleanliness and maintenance must be a factor to be taken into consideration. The laboratories especially must offer guarantees of safety and salubrity.

The library must be in good condition in order to motivate the teachers and the students to use it regularly, and it must contain reading material, research information and appropriate graphic prints.

9.8. Administrative aspects

Ideally, information will be obtained about the administrative procedures ensuring that the minimum curriculum is complied with, that the grades are registered in a secure manner, that the final grade is calculated in accordance with the rules established by the school, that the classroom hours are complied with in accordance with regulations and that the maximum number of times that an exam can be repeated is not exceeded.

The jury must be sure that a student who leaves a certain engineering school has not only the technical and scientific conditions, but has also completed the administrative requirements stipulated by the school. In order to guarantee that this is the case, the jury can, when justified in doing so, inquire into the following administrative procedures:

- Entering and registering of grades
- Individual process per student
- Process per subject
- Issuing of the course certificate
- Calculation of the final course grades
- Attendance control

An analysis of this data which make it possible to quantify the quality of the school's records and procedures is part of the material to be assessed by the jury in exceptional cases in which there are doubts about the guaranteed rigour of administrative procedures. This assessment must be brief and without going into great detail, simply to confirm the administrative guarantees in the school's information processing.

9.9. Institutional culture

The general state of order, the effectiveness of the work, the participation and involvement of people in day-to-day work, the relations among individuals and groups, the group spirit and the defence of the institution's culture and values are aspects enhancing the institution's merit, albeit with the weight and moderation that the intangibility of these aspects call for.

BIBLIOGRAPHY

THE STATE OF THE ART

- Conference of European Schools for Advance Engineering Education and Research (CESAER) – Conference "Quality in Engineering Education" – 1995.
- "The National Systems on Higher Engineering Education in Europe" – Michel Giot and Philippe Grosjean - 1995.
- "Cursos de Engenharia no Reino Unido" - A Salgado de Barros - Ingénium Journal no. 13 - November 1996

- "A Acreditação da Formação no Reino Unido" - A Salgado de Barros - Ingénium Journal no. 14 - December 1996
- Conference of European Schools for Advance Engineering Education and Research (CESAER) – "Total Quality Management in Higher Engineering Education and Research Institutions" – 1997.
- "Modelo de referência e auto avaliação" - A Salgado de Barros - "1ª e 2ª parte" - Ingénium Journal no. 23 and 24 - November and December 1997
- "Workshop on Engineering Accreditation Systems Development", promoted by ABET in 1997 and 1998.
- "Some Considerations on Civil Engineering Education" – Prof. J Ferreira Lemos –AECE Symposium – Odense - 1998
- "A Acreditação de Cursos de Engenharia em Encontro Internacional" - A Salgado de Barros –Ingénium Journal no. 31 – November 1998.
- Standard and Routes to Registration –Engineering Council – U.K.
- "Engineering Criteria 2.000" – ABET – USA.
- "FEANI INDEX" – Schools/Courses accepted for the EUR ING Title.
- "Ordem dos Engenheiros" Congress - Funchal - Paper "Formação Académica: Acreditação de Cursos" – A Salgado de Barros (November 1996)

ASSESSMENT IN PORTUGAL

- "Acreditação de Cursos - um processo evolutivo" - A Salgado de Barros - Ingénium Journal no. 12 - October 1996

- Portuguese Universities Foundation – Assessment Board – External Assessment Guide – October 1995
- Portuguese Universities Foundation – Assessment Board – Assessment News no. 1 – June 1996
- Portuguese Universities Foundation – Assessment Board – Assessment News no. 2 – December 1996
- Portuguese Universities Foundation – Assessment Board - Basic Texts – April 1997

ACCREDITATION IN PORTUGAL

- "Acreditação de Cursos de Engenharia - Manual do Júri" - "Ordem dos Engenheiros" publication - 1994
- "Acreditação de Cursos de Engenharia - Guia para apresentação de candidatura" - "Ordem dos Engenheiros" publication - 1994
- "Acreditação de Cursos de Engenharia pela Ordem dos Engenheiros - Um Processo em Marcha" - A Salgado de Barros - 1997

- "The Accreditation of Engineering Courses in Portugal - A successful System", A Salgado de Barros - August 1997.
- Accreditation of Engineering Courses in Portugal –Iberian-American Congress of Architecture and Engineering – Prof. José Ferreira Lemos - Madrid – 1998
- International Seminar: Schools and Order: Accreditation of Courses and Professional Profile - Lisbon - 1999
- "Acreditação de Cursos de Engenharia – Uma aposta no futuro" - A Salgado de Barros – 2000 – Engineering Collection – Volume 6

III QUALITY MANAGEMENT IN CIVIL ENGINEERING EDUCATION

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1. Introduction

This paper is part of the results of Working Group B under "EUCEET", The thematic network 55779-CP-1-98-1-ERASMUS-ETN: "EUROPEAN CIVIL ENGINEERING EDUCATION AND TRAINING". It was initially produced as a working paper designed as a backup for a survey on Quality Management in Civil Engineering Education amongst EUCEET partners. In its present form it has been revised and rewritten in order to function as the working group's opinion on Quality Management.

2. Quality as a Concept in Civil Engineering Education

In normal perception quality is often thought of like "best possible" or, when compared to something similar, "better than". This is understandable - and quite logical. Another yardstick often used, is "best when compared to resources used or provided", a sort of cost-benefit analysis. Logic again.
However, when dealing with quality assurance and *quality control*[1] , this "normal" perception of quality is not appropriate and, furthermore, when used as an objective in organising and performing education, the application of this perception can arouse confusion and in the worst case lead to decrease in overall quality.

The problem in perception of the concept of quality in education lies in specifying what to look for, judge, measure, etc. Accreditation is very much focussed on quality of the "end product", i.e. the graduates. The employer sees it (understandably) the same way.

It is also true that educational institutions have a great interest in "high quality" of "student output", since this has a heavy impact on the organisation's reputation and esteem; it means a high score in assessments and will also inevitably influence the attraction of - maybe even "high quality" - students.

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[1] The use of the word "control" should here be perceived in the "broader" Anglo Saxon way, i.e. also like "steer", "direct", "guard" or (perhaps most precisely) "maintain".

On the other hand external assessment tends to focus on formal data, such as curriculum size and content, staff qualifications, staff/student ratio, laboratory facilities, IT facilities, etc.

When, however, it comes to using quality assurance and quality control as organisational tools, for internal assessment and audit, seeing graduates as "the product" will - in the best case - prove inadequate, and for a number of reasons: Students are individuals, their merits are very much influenced by their ability and changes in ability on the intake side will influence the measurement. Furthermore, a modern educational institution should be regarded as service organisation, and it would therefore be suitable - without failing to see the needs of the employer - to regard the student as the major customer.

Using "best possible quality" as target is also problematic. First of all members of the organisation will not have a uniform opinion on what "best possible" is. Secondly, what happens if "best possible" is not good enough?

Quality measures should be precise and based on measurable variables. In many cases this can appear to be difficult; this will certainly in many aspects be the case in education and then the job is to formulate goals as precisely as possible at to back goals up with policy which should be as operational as possible. This does, however, not implicate that educators and administrative staff should not strive to the best of their ability, nor should a stiff quality skeleton jeopardise educators' free choice of method - on the contrary. These problems are biassed by concepts like competition and conflict, both of which will be dealt with in the following.

Finally, it should be clear to the reader that it is not intended nor possible in this paper to give detailed recommendations on how to obtain a high quality output. The main objective is to describe the process of Quality Management and to focus on key points in the relationship between on one side structure and functions in educational institutions and on the other side level of quality.

Recapitulation:

The issue of defining "Quality" in education is very strongly connected to the conception of costumer/product.

One can either regard the employer as the costumer and the student as the product. This implies that rate of success must be measured on student behaviour (attitude, ability) or by difference in terminal versus initial behaviour. Goal setting will be difficult and inevitably become "best possible" or similar. Quality Maintenance will be very dependent on of student abilities on the intake side and student examination will become the main "control" tool. Costumer "complaints" can be dealt with only indirectly and usually with great delay.

Or one can regard the student as the customer and "Education" as the product. This calls for goals set at a certain standard not necessarily only linked to academic level. Policy and Quality Measures can be linked directly to "production" variables, which - in an ideal world - can be independent of student ability. Student examination will not act as a "control" tool but as an integrated part of the educational product demanded by the costumer. Costumer "complaints" (in this conception known as course unit evaluation) can be dealt with directly and with high frequency.

One can use either of these two conceptions. In a "traditional" educational institution with heavy emphasis on the endeavour of individuals - and with quality parameters expressed only explicitly - the former would certainly work best. If, however, the institution chooses to formalise the use of QA/QC only the latter conception is applicable.

Sub-conclusion:

Based on the above discussion Working Group B agreed on the following statements on the definition of quality:

1. Quality assurance and quality control will be discussed from the viewpoint that EDUCATION is the "product" to be measured and evaluated - while the students are regarded as the main costumers. By education is understood the core services output of a civil engineering institution, i.e. how courses, course units, project work, laboratory work, field courses, traineeships, exams, etc. are planned, organised and run.
2. The level of quality of a certain education (or part of it) can be measured by the degree of fulfilment of its goal[2] . Level of quality is not equal to academic level. The latter should, alongside other overall intentions, appear explicitly from goals and standards codified by the organisation.

3. Quality Management Structure

Quality management should be regarded as a continuous process, rather than a state of affairs. It constitutes 1) a quality assurance system: description of the product and the setting of goals, 2) a strategy for implementation and maintenance of the QA system, 3) means for "following up" on quality measures, in industry known as quality control - a term that probably should be avoided in education - and 4) audit, a system to measure the efficiency of quality management.

Quality assurance of a certain piece of built environment, say a building, a bridge, is usually done by listing its characteristics in a *quality manual*. In industry characteristics usually are measurable and comparable with preset

[2] Federau, Manfred : "Quality in Civil Engineering Education" White paper prepared for the 2nd international AECEF symposium, Odense Denmark 1997.

standards or tolerances, like colour, size, function, etc., and other important quality assurance factors like the name of the supplier, length of guarantee, etc. can as a rule be described objectively.

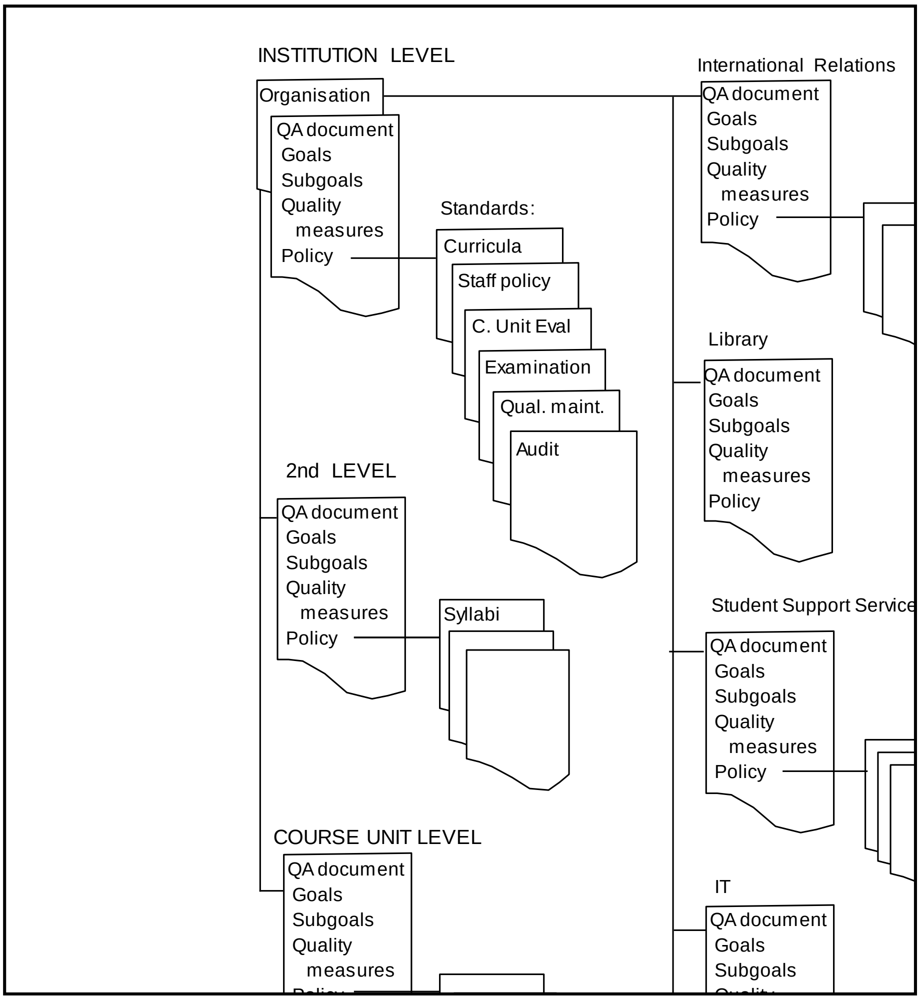

Figure 1. Quality Assurance Structure

When, however, the product to be quality assured is education, the key characteristics cannot easily be described objectively. Usually it is necessary to use a hierarchy of statements, known as goals or objectives, quality measures or standards, policy, etc. as a means of quality assurance.

One big manual, like a "quality bible", is not practical neither to use nor to maintain. The documentation is usually divided, by level as well as by function. The institution will codify superior goals and policy and confirm the existence of documentation at lower levels alongside (institutional) "communal" functions, such as personnel, salary, library, student support services, IT, institutional information system, public relations and international relations, etc.

TN EUCEET deals by definition with engineering education, specifically within civil engineering. Therefore the assurance documentation at department or faculty level is far the most interesting, since nearly all EUCEET partners are situated at that level. Depending on the degree of freedom allowed in goals and policy decided at institution level, the staff-student committee, department board or a similar body will set goals and decide on policy and standards for the education imparted by the department or faculty.

The base level, the staff-student contact zone, is very often forgotten or deliberately left out in connection with quality assurance. It is quite common to leave it at a more or less detailed description of the syllabus in question, mainly on professional content and sometimes just in headings. This is a major mistake and this paper intends to prove the importance of suitable quality assurance at course unit level. On the other hand it is quite common to see quality control solely - or most intensively - performed at this level. These two facts put together is perhaps the ultimate example of bad quality management. Regarding the "direct delivery point" as a separate level is, however, merely a quality management tool. Doing so should not add unnecessary bureaucracy, nor should it conserve or strengthen the often too strong independency in course unit management - known as course unit ownership - on the contrary.

As a rule this subdivision or hierarchy of levels result in three levels of interest: Small institutions will usually have departments with a staff of 10 - 30. Here the subdivision will be institution -, department - and course unit level. Large institutions can have faculties of more that 200 staff and will usually be subdivided in institutes or departments. Here quality assurance at institution level becomes something very distant and thus not inside the scope of this paper.

At all levels strategies for implementation and maintenance of the quality assurance system should be developed and confirmed by the appurtenant organisational body.

Quality assessment is not possible without knowledge of how the institution in question is organised. A detailed documentation of structural as well as functional variables should be made available for staff and students - as well as for an external assessment body. Responsibility for quality assurance and quality maintenance should appear explicitly from this documentation. So should the structure and function of audit.

It is, however, possible to carry out higher education without the existence of a formal quality management system. It is seen done with great success and many educational institutions use measures with very little obligation and a low degree of efficiency. So, what is the purpose of quality management?

One - important but perhaps idealistic - reason could be that the organisation should care about the quality of its services. Another could be the existence of external assessment imposed by Government. A third is that the process itself, the mere fact that staff and management has to work together on creating a quality assurance system, inevitably will enhance cooperation, assist in finding and making use of the full potential of the department or faculty in question.

Furthermore, if external assessment is imposed on the organisation, the existence of an efficient quality management system will enable the organisation to be in control of the situation and, also important, external assessment will be more accurate: what is good will come out good, and vice versa.

There are many ways of arranging a clear quality assurance structure.

Figure 1 gives one possibility, the nomenclature of which will be used in the following description of Quality Assurance units. It must be noted, however, that the organisation structure of an educational institution can vary considerably, hence the importance of including precise descriptions of this in the quality documentation.

Finally some words on internationalisation of quality management. Language is an obstacle; if this project had succeeded in collecting quality assurance documentation from a great number of partners, they would probably in some cases be unreadable to Working Group B members. At least the coordination would be difficult. Since quality assurance have (or should have) a heavy impact on student mobility (by means of credit transfer) this problem should be dealt with. One suggestion could be that Quality Documentation should be in English. This would solve the problem. Another - perhaps not so tense - solution could be that if documentation is not given in English, it should appear in any native language *and in another major European language*. In the latter case it should be stated explicitly which version has the legal "weight".

Recapitulation:

All documentation, be it description of goals, quality measures, policy, strategies, etc. should appear in written form and should be accessible to all interested parties, preferably in electronic form.

4. Quality Assurance in General

Quality assurance is documentation. Characteristics and details of the product must exist in written form. Everyone who has worked with industrial quality assurance knows how this is done. However, not all procedures and techniques from industry can be adopted for use in education. The problem is here that the product is not easy to define, let alone to describe; important quality factors are determined by how individuals perform their work, how these individuals interpret their organisational role and how they decide on important factors, such as methods applied, facilities used, depth of learning, the problem of understanding versus reproduction, the degree of student responsibility of own learning and sometimes also on areas covered in syllabi.

However, much factual information is easily available. Curricula and more or less detailed syllabi has existed long before anyone thought about the concept of quality in education. The same can be said about qualifications of teaching staff, regulation of student input by level of ability, procedures for examination, marking and performance, s/t ratio, average time spent on taking a degree, estimated student workload, etc. No one will argue against these factors being important; they resemble "industrial" quality factors and are also (perhaps because of that) key factors in external assessment. However, a high score in assessment based extensively on these factual variables does not - or at least not necessarily - mean that the institution will graduate a high rate of "high quality" engineers, hence the dilemma in defining quality discussed above.

What is it then, that apart from - and very often in spite of - the above listed factual variable, determine more inherent, more essential, education quality? Working Group B member Alan Kwan has suggested to use the term *intrinsic* quality for this specific concept. Although it does not seem fair when using the official explanation[3] of the opposite concept, *extrinsic*, this will - for analytic reasons - be used to describe quality output determined by factual variables.

Since intrinsic quality in a very high degree is characterised by a sensation perceived by individuals - in casu students - it is not possible to measure in numbers. In order to uncover its nature a comparing with an equivalent concept in work psychology will be made, where intrinsic motivation is contrasted with extrinsic motivation. This is not a metaphor; the intrinsic value of teaching is very much determined by motivation, as applied by methods, facilities and personal appearance conducted by the educator in control.

A. H. Maslow, a well known American work psychologist, ranked motives (needs, desires) in a hierarchy and defined *intrinsic motivation*[4] as the satisfaction of "higher" motives, such as "involvement", "responsibility", "recognition", "challenge", "reward", "work itself", "application of abilities", etc, the highest being *possibility of "self realisation"*, whereas "lower" motives (extrinsic motivation) could be job security, status, salary, spatial arrangements, information, social relations, etc. This is not the place to go deeper into Maslow's theory, however interesting this could be. It should, however, not be difficult to see the similarity with education and it is important to have in mind that it is not a question of "either or"; both types of motivation factors should be used and have an effect. The difference is that satisfaction of "higher" motives have a more dramatic drive effect.

In education intrinsic motivation is perceived when students are driven by the need to understand what they are learning because they have experienced

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[3] The explanation of the terms *in-* and *extrinsic* is that of: "The Concise Oxford Dictionary of Current English", Oxford University Press, fifth edition 1964.

[4] See for instance: Maslow, A. H.:"Motivation and Personality". New York: Harper 1954.

this is the only way to achieve the reward, the mastering of challenges. In engineering education as well as in almost all engineering work this means solving problems. A very good example is to look at how the use of computers motivates, influences the learning process. Here the challenge in mastering programmes is so strong and the reward in being able to demonstrate what one can do with them so all-powerful, that education is hardly necessary - though an instruction in many cases will speed up the process. This factor is so strong that it can lead to drawbacks; the students can spend too much time "playing" with computer programmes and - "unfortunately" computer games has the same drive.

Using intrinsic motivation in education means making students active. It is not enough to recommend reading. When meeting an obstacle when using computers, students do not read the manual and if they do it is as a last resort - they do not even care to buy one. Students of today treat textbooks the same way and the educator has to realise this fact.

If intrinsic motivation is applied successfully, the intrinsic quality of the product will increase. *And*, if these values are used as target by management, the level of quality - as defined in this paper - will increase too.

Extrinsic motivation is easier to describe. If the student is driven more by "studying to pass exams" than by "studying to be an engineer", this is a good overall view of the concept. Course units are run because they are considered to be "useful" to have in curriculum; perhaps they are taught because the appurtenant areas "must be covered".

All educators know that large amounts can be covered by lecturing and in many cases this method can certainly be an efficient way to pass on information, especially if it is direct linked to and backed up with tutorials an exercises; it can even contain intrinsic values. However, students are not active during lectures, and if the audience is large communication will tend to be one-way only.

Engineering education is known for using much time on going through examples and this means is certainly indispensable in demonstrating practical application of science. Students are usually "active" during this process, at least in that way that they copy all examples passing the blackboard. This is understandable seen from the students viewpoint: examples are regarded as being "relevant".

If examples are used extensively, especially when used as the sole alternative to lectures, and if the educator is stressing this as being "important" this could be a demonstration of how extrinsic motivation works. This effect can be strengthened by handing out worked solutions and by extensive use of "compendia" showing "techniques" more than supporting "understanding". Furthermore, if the way examinations are performed reflect this attitude - written examination with unlimited use of electronic and written aids are quite common in engineering education - the impact of this on student behaviour will strengthen the effect.

If management supports extrinsic quality variables like the ones described above , or one should perhaps say allows them or totally neglects the existence of such variables - because usually very few quality measures are codified in this field - this is an example of extensive use of extrinsic quality as a yardstick. If this leads to success, if a suitable number of students pass exams, if course unit evaluation is positive - and they quite commonly are in this case - the level of quality as defined in this paper will be high. Since external assessment usually concentrate on measuring extrinsic quality, this could also lead to a high score. Everyone could be happy! What is wrong with that?

It is an important *hypothesis* in this paper that if intrinsic values are *included* in quality assurance, assessment - be it external or internal - will in a more explicit way reflect what interested parties in engineering education are looking for. It is an underlaying hypothesis that most experienced educators are aware of the existence of these values, but also that the question of how to implement action leading to intrinsic quality is looked upon very differently - and in many cases not answered. Furthermore, intrinsic quality reflects universal values important for long term professional development (competence), whereas extrinsic quality in its pure form reflects values more quickly being obsolete (qualification).

Alongside factual documentation represented by curricula, syllabi, organisation plan, etc. quality assurance is (and can only be) done by stating intentions in written form. These take the form of (see figure 1):

1. Goals (or objectives). These are usually overall considerations of what to aim for; they are usually difficult to subject to quality maintenance.
2. Quality measures, which are goals that can be objectively measured and which can and should be included in quality maintenance.
3. Policy, which are intentions with the purpose of the "backing up", the specification and the braking down in manageable details of goals. Though the distinction between policy and quality measures can be "blurred", quality policy is usually not easy to subject to control. Intentions stated as policy should, however, have a high degree of operationallity.

In the following these quality assurance functions will be described more in detail.

5. Goals

The main overall ruling goal for almost any organisation is *long term survival*; this also goes for educational organisations. This is normally (best) left to exist implicitly in the quality documentation; the same can be said about statements like: "We intend to be (or are) the best, and the following documentation will prove it".

Although main goals tend to express more or less "chromium plated" intentions they should reflect the *overall general idea or purpose* of the activities. Another important factor is that main goals have a *signal value*, they can be used as part of PR and in assessment situations.

One way of taking "sparkle" out of main goals is to focus on the interested parties of the organisation, employers, students (and graduates), staff, society, professional associations being the most prominent ones. When formulating goals it is possible to avoid unrealistic "radiation" by - as suggested in this paper - to regard the product to be education and students to be customers. This does not necessarily be done explicitly; in the case of looking into the interest of students this could be done like:

"It is a main goal to plan, organise and perform education in a way that secures the student an efficient, challenging and inspiring study period and gives the graduate an ideal platform for life long professional and personal development".

It is a good idea to subdivide main goals, and focus on interested parties is one way of doing so: "Students", "The Profession", "Employers" and "Society" will appear to be the most obvious ones.

Main goals must reflect the profile of the organisation and its product, and statements connected to the needs of interested parties does not always fulfill this purpose. An education can be focussed on the development of more general engineering abilities or on specialisation and this should be defined. Another important balance is that between training and the implementation of general engineering abilities. Some courses, like the British sandwich model, the Danish and German leading to "diplomingeniřr" and "diplomeningeniur FH" respectively intends to impart a larger amount of practical or even direct applicable skills. Since this factor has a heavy impact on the way quality is valued by interested parties and can have serious consequences for mutual institutional recognition and cohesion, it should be specified.

Other aspects that could mirror the educational and institutional/departmental profile should be included; this could be the interaction between education and research, the influence of international relations and so forth.

The above description is focussed on the general concept of goal setting. The choice of method will - as mentioned earlier - depend on the subdivision in levels: Goal setting at departmental level must confirm - in a specific and more detailed way - with those at institution level, and those set at course unit level must exist within the framework of departmental targets. Sometimes a further subdivision in main goals and subgoals could be prudent and supply a better structured documentation.

Goal setting at course unit level deserves special considerations. As mentioned earlier quality assurance at this level is often not appropriate. The same can be said about goal setting. They often exists only implicitly, they are regarded to be understood by all parts of the process. This laissez faire situation might work, but it certainly has serious drawbacks.

One could argue that *the intentions of* a certain part of education should be controlled by the educator in charge. This is, however, an "all other things being equal" statement and in a system without formal quality assurance at course unit level (probably the normal situation) it is also obvious and possibly the best way to proceed: He or she is the expert and should have the full responsibility and in an ideal world the good educator will "feel" and follow even implicitly existing "company policy".

The decisive difference when or if formal quality assurance is implemented at that level is that the system becomes transparent. Management and the customer can "read" the situation and act accordingly. It is certainly true that the educator must be an active part in the quality assurance of the course unit i.e. be responsible for and do the documentation work.

If the education in certain course unit relies on knowledge supposedly imparted in other course unit(s) and intentions are different, the quality could suffer in both situations.

There are many advantages of proper quality assurance (documentation) of course units. Management will be able to fine tune curricula, colleagues will have a better change to adjust syllabi to fit together and form the intended product and - perhaps most important: students will explicitly know what they can expect from and what is intended by the educator and what the system expects from them. In short: Al interested parties will know - or have a chance to find out - what goes on. Furthermore, a detailed quality assurance is a priceless tool when developing and introducing new courses, when lecturers change courses, when new lecturers are signed on, when one lecturer has to "stand in" for another or when lecturers do teamwork. Collegiate supervision can be performed easier, more professional and with less drama.

The disadvantages of improper quality assurance are well known, the most serious one being the lack of possibilities to exercise quality maintenance. Course unit evaluation will be reduced to measuring whether or not students are "happy" which have little or no relation to level of quality. It is even probable that "high scores" under these circumstances will indicate a low level of quality and - more serious - especially a low level of intrinsic quality.

It is sad to realise that lecturers have been sacked based on inadequate, vague assumptions of quality or on misunderstanding of intentions. Likewise it is quite common that external assessment - also based on biassed assumptions - results in low scores in this field. The medicine prescribed is almost always: courses in pedagogy or "get rid of old stubborn and conservative teachers". This can be true, at least to some extent, but the major part of this kind of problems can be solved by exercising adequate quality assurance.

It is certainly true that staff development - both professionally and in the pedagogic area - is an important issue. However, the normal trend is to make use of external courses for individuals - those who "need" it and sometimes for those who "can find the time" or "feel like doing it". The result of this is often that it can strengthen these peoples feeling of being "on their own", their frustration of not being able to implement and use what they have gained of new ideas. A different approach to this could be to make use of the institution's full potential of knowledge, to run courses internally involving its own "experts" and - most important: combine staff development with quality development, "force" colleagues to agree on the effect of intrinsic variables.
An extra benefit is increased control over external assessment, better ability to "guide" this into being more precise.

In conclusion it should be mentioned that actions taken towards more transparency in course unit documentation often is thought to cause tensions and personal problems. It is also by educators regarded as "more work" though it should be a natural part of course unit planning and preparation. If, however, it turns out to function - or to be felt like - a revolution, this is merely a sign of necessity.

6. Quality Measures

Unlike in industry listing of direct countable or measurable values in education is not straight forward. The true and really important variables are factors influencing personal development and the true way of measuring level of quality is to look into how successful individuals perform "quality engineering" - and in a great variety of capacities. The task is to make this theorem operational, to find finite characteristics in the product that, when measured, show a direct link to stipulated goals.

When stating quality measures one should constantly have one eye on the possibility of feedback. Are they really possible to become subject to measurement? If not it is often better to catalogue them under policy.

An example:

If the institution wishes to stress internationalisation this could be stated as: "It is a major goal for NN that at least P % of its students take their traineeship abroad". This is a clear and countable target. However, the target could be set somewhat "softer", like: "The success of NN's endeavour in this field should be measured by the number of students who take their traineeship abroad". This could be part of a list of "commitments" of the same sort: "... by the number of international events arranged by NN", "... by the number of employees taking part in international work", "... by the number of employees who gain membership in steering bodies of international organisations", etc.

The design of curricula and, in a more detailed form, of syllabi will spot several important quality measures. At the overall level the choice of study lines with specific curricula will show the profile of the institution and requirements on content will link more directly to overall goals, such as the balance between theory and "training", emphasis put on internationalisation and degree of specialisation. A structure with study lines having a communal basis or requirements on obligatory merit transfer between study lines fall in the same league. All these elements are well known but not so often recognised as important quality measures. It is, however, not adequate that they can be read only implicitly from a "catalogue" of courses and from syllabi being rough descriptions of content. In a well designed quality assurance system they must exist as precise and justified quality measures in a written and manifest form as a platform of efficient quality management.

One could, from the above given definition, think that quality measures appearing from curriculum design are purely reflecting extrinsic variables. This is not true and though this is not the place for recommendations, some factors can be brought into attention.

First of all many curricula look like they do for "historical" reasons, because "this is the way we use to do it" because "most others do it this way", because "this is what employers - or assessors - expect" and so forth. There is nothing wrong with such reasons, they are signs of stability and form a recognisable professional "breeding". But on the other hand do they not necessarily reflect what is really needed. In many cases the construction of curricula is based on "what can be achieved with facilities and staff available". This can be necessary for a host of reasons but in an ideal world it should be the other way round: A strategy should be developed on "how to come from A to B", on how to adjust equipment and spatial arrangements, on how to reassign or train staff to fill requirements.

As mentioned earlier is a good technique in this endeavour - not just for the argument, but for analytic reasons - to regard education, in casu the curriculum as the product and the student as the customer. Another fact is that the mere exercise of codifying quality measures, and especially that of effectuating the underlaying analysis, will make management and involved individuals alert as far as looking for and finding intrinsic quality variables is concerned.

Another important and often overseen factor is size of curricula, and for that matter of syllabi. It is a fact that due to a constant increasing flow of information, of new techniques, of new areas that "must be covered", uncontrolled growth is an acute problem. At the same time the work load students are prepared to accept is decreasing. This point should be subject to setting of precise quality measures; if it is neglected the result will inevitably be superficiality and a decrease in intrinsic quality.

As examples of quality measures related to curricula - fixed at institution level - could be mentioned the amount of basic science, "application related" content, electives, social science, etc. It goes deeper; if for instance the application of certain methods of learning is perceived as an important factor[5], the content of project -, group - or problem based education could be codified at institution level.

The judgement of the quality level of course units will be based on quality measures codified at department or faculty level in correspondence with those on a higher level. Apart from the above-mentioned factors, requirements on type of unit (project, exercise, theory, etc.) could be prescribed, while the application of specific means like problem-based learning, computer aided learning, group work, etc. could be either fixed or left to be decided by the lecturer in charge. In the latter case direct setting of quality measures should be substituted by policy reflecting the intentions.

One category of quality measures often not regarded as such is requirements on course unit documentation, what it should constitute and to which degree of detail it should be effectuated. Sometimes course units are run without any formal (written) planning, implicitly understood by textbook material used or given by a rough subdivision of time used on different topics. This may work, judged isolated, even sometimes with success but as mentioned above under goal setting, the drawbacks seen from an overall quality assurance viewpoint are immense.

The following examples of quality measures could illustrate some possibilities, some of which also reflect the impact of intrinsic quality parameters:

- How much volume is used on going through examples?
- Are home work problems specifically designed to back up on theory involved?
- Is handing out of worked examples standard procedure?
- Is handing out of "standard solutions" of home work problems standard procedure?
- Is it standard procedure to "go through" home work problems after correction/marking?
- Is random use of old exam problems as home work normal procedure?
- In the case of written student examination, is it standard procedure to allow all sorts of aid?
- In the case of oral student examination, is it standard procedure to hand out beforehand a detailed list of exam topics?
- etc.

Questions like these can be transformed into formulated quality measures or into policy depending on how strong the intentions are. However, doing so means to move into an area normally perceived as the lecturers "freedom of

[5] Engineering education at Aalborg University, Denmark is an example of this.

method". In many cases one would hesitate to formulate "in general" such "delicate" quality measures - and with good reason. Another possibility is to work more indirectly, to demand a documentation (here study planning) so detailed that questions like the above stated can be answered. Another tool could be to demand the lecturer in charge to formulate goals (intentions) and quality measures and/or policy to back these up.

This is not the place nor the time to submit specific recommendations on how course unit documentation should be done; the message is to point out the necessity of decision taking in this field. The same can be said about having the person in charge, i.e. the educator responsible for the course unit in question, make the appurtenant information available to interested parties. With to-days choice of electronic means the possibilities are legion. All quality documentation should appear on the institution intranet or - why not - on the internet? Furthermore, an obligation to make quality assurance transparent through publication will serve as a motivation to take the job seriously and will ease quality maintenance.

7. Policy

The question of where to catalogue intentions cannot be answered clearly. If a direct statement on quality measure is possible this will function stronger and more firmly. On the other hand will the formulation as policy give more room for flexibility.

The example above: "It is a major goal for NN that at least P % of its students take their traineeship abroad" could be formulated as policy for example in this way: "It is policy that all students should have the opportunity to do their traineeship abroad and International Relations should be given resources adequate to efficiently support students in this endeavour".

Policy on quality will usually cover many areas. A white paper from the 2nd AECEF Symposium[6] presents a detailed list with the following headings: "Educational structure", "Academic and professional content", "Means of education", "International relations", "Relationship with society", "Social relations", "Examination" and "Course unit evaluation".

To this list should at least be added policy on "Audit", on "Quality maintenance" and "Staff policy". Many of these "set of statements" will exist on several levels and the question of how to compose them and link them up with other elements of quality assurance is more or less a question of taste. In many cases, especially as far as policy covering overall conditions is concerned, it seems practical to design documents suited to stand alone, as institution or

[6] Federau, Manfred, op. cit 1997.

department standards. This could typical be "Staff policy", policy on "Course unit evaluation", "Examination", etc., see figure 1.

8. Quality Maintenance

As a concept quality maintenance is somewhat broader than quality control; in an educational institution it seems natural to regard the latter to be included in the former. The task is to *check on* quality measures and level of quality and to *initiate action* should the status be inadequate. It is important to realise that this function is a process, a constant process, not a state of affairs. It also implies that quality measures should be adjusted downwards and policy should be reformulated respectively, should the targets be unrealistically high and also, vice versa, to push them further if development shows that this is prudent, providing it is possible.

In many cases checking quality level and measuring quality indicators is straight forward and there is no reason for a detailed discussion of the general aspect of this function. However, when it comes to dealing with intrinsic quality, the task can be more difficult because 1) measurements are often based solely on policy and therefore dependent on how clear and precise this has been formulated, 2) many important intrinsic quality indicators are situated at course unit level, where "external" interest can be regarded as "interference" and cause collegiate tension (see above). Overcoming such obstacles is a core objective in quality management.

As discussed at the 2nd AECEF symposium[7] there are two elements of educational management with an apparent content of control: course unit evaluation and examination. However, the management value of even these elements very much depend on the conditions under which they are performed.

Course unit evaluation is usually done by means of a questionnaire filled in by the students. The problem is that the student will react very individually, according to his or her general expectations, interest in the course unit, study ability, stress situation, expectation (or fear) of how exam is planned or will turn out, personal view of education *and of the educator*, experiences gained from course units studied previously or studied in parallel with the one in question, etc. Another weakness of course unit evaluation is that usually (for practical reasons) the course of exams are not included.

As stated earlier in this paper course unit evaluation can be made more valuable as a quality tool by formal quality assurance at this level. It is true, however, that much useful information can be gained even with no or little written documentation. Things like degree of attendance and work load can be deducted and - most important in this situation - it is possible to gauge the

[7] Federau, Manfred : "Control in Educational Organisations". Paper prepared for the 2nd international AECEF symposium, Odense Denmark 1997.

students feeling of how the educator functions: degree and quality of preparation, use of visual aids, ability to motivate, social and professional attitude and other more specific pedagogic variables. Still, evaluation will be concentrated on the educator, strengthening the normal dilemma: The student wants to evaluate the teacher and management (and the teacher) wants the course unit to be evaluated.

The first step in documentation is a detailed study plan. It can be done lecture by lecture and it is possible to include statements on the intentions concerning the areas covered. The student can be given useful information on how to prepare for the lecture or - in case of absence - how to catch up. As far as quality maintenance is concerned a detailed study plan offers at least two advantages: 1) Management and other interested parties are given a chance to judge how content and intentions match target setting and 2) The questionnaire can be specific on quality variables: Was the plan followed? Did it give adequate information on the course unit? Did the distribution between elements (lecturing, exercises, examples, etc.) follow the intention on balance between learning of basic principles and training for the profession? And so on.

As far as course units run as project organised learning are concerned documentation is even more important. The problem is here to keep the balance between setting targets and avoiding to disturb the process of creativity and the reward value in solving the "case". Sometimes this dilemma is used as an excuse for leaving it to accepting or handing out a project tittle, in which case chances of gaining high quality are remote - and none existing if quality is defined as in this paper. At least should be required the purpose and target group of the project: "Who "ordered" the report? Who is going to read it? And what is it going to be used for?" Furthermore, a thorough documented initialisation of projects used as a means of learning is extremely important.

Another important thing is the character of problems and their use as examples and home work. There is (or should be) a great difference between problems especially designed to back up or feed back on the lecturing of technical and scientific principles, exam problems and problems designed to train practical skills, such as design, use of codes, etc. Proper quality assurance requires that problems and examples must exist as documentation and that they are linked individually to lectures or other pieces of education. Random use of old exam problems has a bad quality signal value!

The administrative questions round course unit evaluation, i.e. should it be anonymous or not, should the results be made public, consequences of bad (or good) scores, etc. are also important tools in quality management. They will not be dealt with in detail in this paper.

Exams are examples of educational elements with an apparent content of quality control. In an ideal world, i.e. if examination is organised (exam problems designed) to measure exactly what was intended, they could be priceless tools in quality control, especially because they take the form of an output quality indicator. However, every experienced educator or educational management person knows the pitfalls.

Starting in 1995 "Center for Didaktik og Metodeudvikling" (CDM) at the Technical University of Denmark (DTU) has run a comprehensive project on quality development. Among other things the report[8] discusses in great detail the value of exams as an indicator of what students gain professionally from course units.

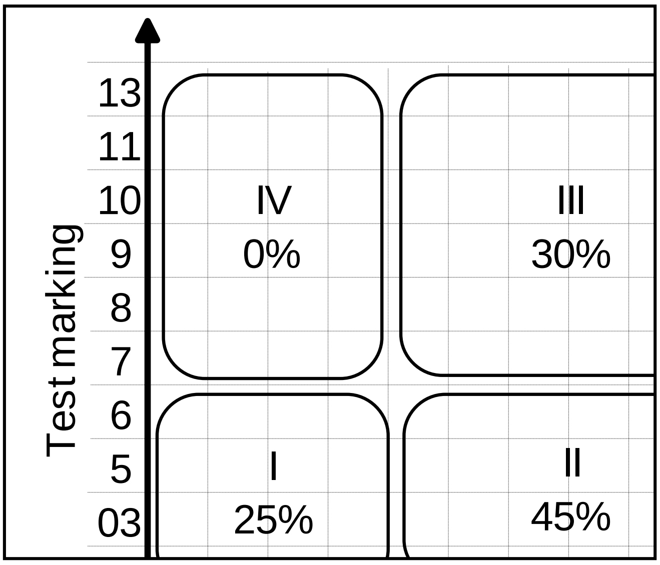

Figure 2. The relation between exam results and test merits. DTU 1999

In the project tests were used to check on students' degree of understanding important scientific concepts underlaying exam problems, the same students had been trough in a written examination.

For example one part of a test concerned Bernoulli's equation:

"Describe qualitatively the physical meaning of the single terms of the equation" and: "What are the conditions for using the equation?"

Figure 2 shows a weighted average of several exam results against appurtenant tests. The size of group II, meaning 45% of the students who passed exam failed the test, caused some turbulence when the report was published. However, in educational circles this is a well known reality and one should be more comforted by the fact that none of the students who failed exam could pass the test. Besides being concerned about how little or how much students gain from following course units, one could from these findings discuss the conditions of using exam results as a quality measure.

[8] Jacobsen, Arne et al.: "Kvalitetsudviklingsprojektet Faglig Sammenhæng" Hovedrapport. CDM's skriftserie nr. 1, DTU 1999

First of all, if the intentions of a course unit, as expressed in goals and policy, does not exist formally or only implicitly, the above quoted findings say nothing about level of quality. If the intentions - by the student or by others - are perceived something like: "The ability to reproduce the use of standard methods by solving technical problems aided by ready available standard formulas and worked examples", then level of quality would be high; 30% of the students even understood, what they were doing. However, the fact that the above findings can arouse surprise indicates a certain imbalance between intentions (quality assurance) and exam (quality control). The situation is worsened by the fact that (apparently important) intrinsic values to a great extent are missing: level of quality, as defined in this paper, is low.

The report mentions the generally accepted assumption that students usually have a precise feeling of whether or not education given (the product) is suited to prepare them properly for exam. One could guess - and it is stated that the course units are regarded as "good" ones - that in the above described situation the course units have scored high in course unit evaluation. This also tells something about the value of course unit evaluation as a quality control tool.

Figure 2 illustrates a good way of describing this specific quality control element. Ideally students should fall mainly in groups I and III and the balance in size between these would then indicate level of ambition in academic target setting. Fluctuation in time would then - providing standards can be kept static - indicate variation in other factors, student ability on the intake side being an important one.

A lesson learnt from the DTU project is that "knowledge" tests are an excellent means of quality control. However, it is time consuming and - as also stated in the report - it is difficult to motivate students to go through tests after exam! Another solution could be to use the tests "as exams", to make greater use of oral examination.

Working Group B members think that the above discussion strongly underlines - as stated earlier in this paper - the importance of proper quality assurance at course unit level. The proposed survey should uncover variations in use and degrees of detail and transparency among educational EUCEET partners.

9. Audit

This element is an important part of total quality management. The concept of audit is very often misunderstood; it is not quality control, it is a "follow up" on or control of the efficiency of QA/QC. It can be stated that the existence of audit is what makes quality management a process and not a state of affairs.

Audit can be performed internally or by an external body. In the case of external assessment an audit will - at least in an ideal world - inevitably be included, providing a formal quality management system is being exercised, hence the postulation earlier in this paper that a detailed and efficient quality management system to some extent can "control" external assessment - or secure that assessment measures what should be measured.

However, it is not the *major task* for external assessment to look at quality management efficiency, it will - as mentioned earlier - usually be focussed on quality *itself*, as this appears from curricula, facilities, student ability input level, student and graduate statements, observations made by external examiners and employers, etc. Furthermore, assessors will seldom have the time, nor the ability to check the efficiency of intentions backed up by policy only, typically intentions assuring intrinsic values. It is therefore prudent to organise an independent internal audit function.

In small and moderate sized organisations audit can be arranged to function inter-departmental and will exist due to policy - if not more detailed standards, see figure 1 - codified at institution level. If department staff exceeds 40 - 50 a subdivision could be more practical.

Auditors job is not to check on quality. This fact can cause difficulties when it comes to reporting, because they gain detailed information on level of quality through their work. There are two different functions: 1) To monitor how well knowledge of and information on quality assurance actions "sinks" from management level to lecturing level, from "system" to customers, 2) To procure factual information on applicability and efficiency of quality assurance and quality control necessary for management to perform quality maintenance. For example, in the above described DTU project it is not the job to criticise the level of quality output, but to pass on the observation that the control element used (exam) does not measure what (apparently) should be measured (probably) because quality assurance is inadequate.

10. Conclusion

The quality of civil engineering education can be secured and developed in many ways - also without a system of documentation like the one described above. It is, however, a fact that the development of new information and the constant growth in accessibility alongside development of electronic means, not only for engineering work but also for the pedagogical side of education, calls for an efficient and dynamic tool for controlling the development of engineering educational institutions. It is the hope of Working Group B members that this paper can contribute substantially to the debate on this subject.

Another aspect is the change in demand from interested parties. Students of today hesitates to accept a "dusty" and static educational system and retreats into more dynamic and "interesting" areas, the profession turns on pressure by means of accreditation and - government has seen that the growth in freedom to choose content and means inevitably calls for control. All over Europe external assessment has become an important factor in organising and running educational institutions. This may not always be popular but it is the impression of Working Group B members that a dynamic and flexible system of quality assurance not only makes it easier to cope with external assessment - it can also contribute to the development of external assessment systems.

IV RESULTS OF SURVEY ON QUALITY MANAGEMENT IN CIVIL ENGINEERING EDUCATIONAL INSTITUTIONS

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Preamble

The questionnaire was circulated to all EUCEET partners in April 2000 and 26 were returned before the deadline 25 May 2000 and two more after the deadline. The total, 28 responses, makes approximately 50%.

The responding institutions are given in table 1 in random order.

One could argue that 28 institutions make rather a small sample. However, it appears that they cover 21 different countries and are well distributed throughout Europe, from Eastern and Middle to Western European countries, as well as between Latin and Northern European states.

Before reading this report please note:

The statements in this report make no judgement on the level of quality of education imparted by the participating institutions. This report is solely on how Quality Management is planned and performed in the institutions involved.

The questionnaire to which this report refers is attached as an appendix. For double reference the scores of the questions are added to the questions. In some of the questions of the questionnaire references are given to "Preliminary Paper". In these cases the paper by Manfred Federau "Quality Management" should be used as reference.

Table 1. Institutions participating in the survey.

Institution	**Country**	**Resposible person**
Vilnius Technical University	Lithuania	Vainiunas
Czech Tecnical University	Czech Republic	Machacek
Lunds Tekniska Högskola	Sweden	Barmen
Poliehnica University Timisoara	Romania	Dimoiu
Riga Technical University	Latvia	Smirnovs
Budapest Uni. Of Techn. And Ec.	Hungary	Farkas
FEUP Porto	Portugal	Marques
Cardiff School of Engineering	United Kingdom	Kwan
ETSI Madrid	Spain	Juan-Aracil
Bialystok Technical University	Poland	Lapko
Slovak University of Technology	Slovak Republic	Fillo
Aristotle University of Tessaloniki	Greece	Latinopoulos
University of Pardubice	Czech Republic	Sertler
Brno University of Technology	Czech Republic	Materna
Tecnische Universität Dresden	Germany	Ruge
Technische Universiteit Delft	The Netherlands	Wasmus
University of Liege	Belgium	Fonder
Fac. of Structural Eng. Sofia	Bulgaria	Totev
Technical University of Gdansk	Poland	Urbanska-Galewska
INSA Lyon	France	Kastner
Danmarks Tekniske Højskole	Denmark	Wilber van der Meer
Helsinki University of Technology	Finland	Jutila
The Eng. College of Odense	Denmark	Hansen
Cracow University of Tecnology	Poland	Biernacki
University of Maribor	Slovenia	Premrov
Katholieke Universiteit Leuven	Belgium	Berlamont
Universita degli Studi di Firenze	Italy	Angotti
Technical University of Kosice	Slovak Republic	Priganc

1. Quality Management and Organisation

The intention of Q 1.2 was twofold: To uncover how the institutions are structured organisationally and to define how the answers to Q 2.1 through 2.9 could be answered in "levels".

As far as the former is concerned, nothing useful could be deducted apart from the fact that all respondents are part of an integrated system; none of the (few) partners operating as universities of civil engineering have responded.

Table 2. Quality Management and organisation (Q1.1 – 1.2) and Quality Assurance (Q2.1 ÷ 2.19) Where answers require “YES” or “NO” designations 1 and 0 are used respectively thus making it possible to calculate (M)ean.

No	1.1	1.2	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	2.11	2.12	2.13	2.14	2.15	2.16	2.17	2.18	2.19
1	0	d	1	0	0	0	0	0		3	0		1	0	0	0	0	0		1	
2	1	d	1	1	1	1	1	1	0	9	1	1	1		1	1	0	1	1		
3	1	f	1	1	0	0	0	0	0	10	0		1	1	1	1	0	0		0	0
4	1	d	1	1	0	0	0	0	0	8	0		1	0	1	1	1	0		0	0
5			0	1	1	1	1	1	1	13	1	1	0		1	1	1	1	1		
6	1	s	1	0	0	0	0	0	0	14	1	1	1	1	1	1	1	0	0	1	1
7	0	d	1	0	0	1	0	0	0	15	0		1	1	1	1	1	1	1		
8	0	d	1	1	0	0	0	0	1	20	0		1	1	1	1	0	1	0	1	
9	1	d	1	1	1	0	0	0	0	4	0	1	1	1	1	1	1	1	0		
10	0	d	1	1	0	0	1	0	0		0		1		1	1	0	0	0	0	
11	0	f	0	0	0	1	1	0	0	50	0		1	0	1	1	0	0		1	
12	0	f	1	0	1	1	0	0	0	9	0		1	0	1	1	0	1	1		
13	0	s	0	0	0	0	0	0	0	50	0		0	0	0	0	0	0		1	1
14	1	d	1	0	1	1	1	1			0	1	0	0	1	1	1	0		0	1
15		d	1	1	1	1	1	0	0	9	0	1	1	1	1	1	1	0		0	0
16	0	f	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	1	1
17	0	f	1	1	0	1	1	1	1	8	1	0	1	0	0	1	0	1	0	1	1
18	0	s	0	0	0	0	0	0	0	5	0		1	0	1	1	0	0		1	1
19	0	d	0	0	0	0	0	0	0	10	0		1	0	1	1	0	0		0	0
20	0		0	0	0	1	0	0	0	20	0		1	0	0	0	0	0		0	0
21		d	0	0	0	1	1	1	1	12	0		1	0	0	0	0	0	0	1	1
22	1	d	1	1	1	0	0	1	1	15	1	0	1	1	1	1	1	0	0	0	1
23	0	d	1	1	1	1	1	1	0	3	1	0	1	0	0	0	0	0		1	1
24	0	f	1	0	0	1	0	0	0	15	0		1	0	0	0	0	0		1	1
25	1	d	1	1		1	1	1					1		1	1	1	1	1		
26	0	d	0	0	0	0	0	0	0	1	0		1	0	0	1	0	0		1	1
27	0	d	0	0	0	1	1	0	0	30	0		0	1	0	0	0	0		1	1
28	1	f	1	1	0	1	1	1	0	17	1	0	1	1	1	1	0	1	0	1	1
M	0,36		0,64	0,46	0,30	0,54	0,43	0,32	0,20	14,4	0,26	0,60	0,82	0,38	0,64	0,71	0,32	0,32	0,38	0,64	0,72

The answer to Q 1.1 is a clear NO and it appears that it is still stronger, since many institutions giving YES show NOs in other decisive areas. Furthermore, three institutions have not been able to decide whether or not they have a formal QM system.

2. Quality Assurance

In most cases the answers to Q 2.1 through 2.9 were a clear YES or NO. In the case of differentiated answers most weight has been put on level [2] apart from 2.9 (balance between "routine" and "theory") where the inclusion of level [1] was demanded.

The answers to Q 2.1 through 2.9 shows that formalisation of Quality Assurance is quite weak; only Q 2.1 is a clear YES but this goes mainly on the institution as such (usually broad, not binding statements) and combined with the other results in this group this indicates very little significance.

It is surprising so few institutions have a written staff policy and also that formalised introduction of new lecturing staff to teaching is not more common. The latter, however, does not necessarily mean that introduction is not being used, only that it apparently is given little emphasis. It appears (also when other factors - see below - are taken into consideration) that lecturers in civil engineering are very much "on their own".

The answer to Q 2.9, the balance between "routine" and "theory", and Q 2.9 combined with Q 2.10 is interesting - and a little alarming. The answer is a very clear NO and, furthermore, only three institutions indicate that they also "have worked this out in clear cut, operational quality measures". This means that the value of answers to Q 2.9 could be lower, maybe 0.15 or less. The combination NO to 2.1 and YES to 2.10 (three cases) is difficult to explain, but this fact could strengthen the impression that in this field decisions are ruled very much by tradition, and the interpretation of tradition could rely on individual judgement.

Q 2.7 (on IT policy) is asked very broadly and in the light of this, the tendency - a very clear NO - is surprising. The possibility to answer in levels here could give a chance to distinguish between more overall counting goals and policy (levels [2] and [3]) and more binding and operational statements at level [1] which could include the use of Computer Aided Learning. This is not the case; answers are in most cases identical across the different levels. The student/PC ratio is generally very high and could be even higher, since three institutions do not give an estimate. In this field the availability of resources clearly plays an important role and the distribution on countries (not indicated here) underlines this fact. If computers should be used (also) as a learning tool one would expect that the ratio should be lower than six to eight. It can be concluded that the results in this area indicates that civil engineering education in Europe is not up to standard in using IT in a dynamic way.

Q 2.11 through 2.19 is on documentation of course units. The most striking thing is that in one third of the institutions lecturing is done without the obligation to publish a study plan. Still more than 80 % claim the existence of goal description at course unit level. Given the answers to the other questions in this group one can conclude that this must be done in a superficial way (confer Q 2.11 with Q 2.9/2.10). It also underlines the fact that all institutions have some sort of course unit catalogue where content and intentions are described in headings. The answers in this group taken in general more than indicates that quality variables at course unit level are strongly controlled by lecturers running (owning) the course units. The impact of this fact on quality level will not be discussed here. More significant from a management point of view is that course unit "ownership" combined with lack of transparency (also indicated here) will cause difficulties when it comes to performing Quality Maintenance.

3. Course Unit Evaluation

The reason for taking this subject to a more detailed examination is the assumption that it is widely used and in many cases regarded and perceived as an (the most) important quality control tool. Another assumption was that Course Unit Evaluation (in the following referred ta as CUE) is the only formal tool for quality maintenance. All assumptions are proved to be right (for the latter please confer with table 5, Q5.8).

Even with the quite narrow expression "... a rule or a very strong governed principle .." the response to Q 3.1 is a quite clear YES. If the expression " ... being used ..." or "... normal procedure ..." had been used, the figure would probably had been 0.80 or higher. Also the phrase "... all course units ..." will have influenced the score.

It is also a fact that in this field a certain amount of formalisation can be found. If the three NOs mistakenly given in Q 3.2 followed by NO to 3.1 are taken away the score for having a very strong policy on how CUE should be performed be as high as 0.89; a very clear YES.

It is no surprise that the use of a questionnaire is common, here three quarters even say it is mandatory. More surprising is the fact that such a large proportion find the use of a standard questionnaire satisfactory (Q 3.3), especially when compared with the fact that nearly eight out of ten with CUE "... intend to measure parameters other than pedagogic ones ..." (Q 3.11). This could indicate that CUEs in general not are done in a very detailed way.

Anonymity in answering questionnaires (Q 3.5) is standard procedure, it is also a sign of democracy and a way to give students - or at least make them feel they have - real influence. It is, however surprising that so few (25 %, Q 3.6) have found (or are using) a system to make it possible to trace students in the event of a "case". When compared with the response to Q 3.12 (the use of CUE for "other purposes, such as staff evaluation") the answer is a little frightening, 0.42 is not a very strong NO. The response to Q 3.8 ("are results of CUE submitted to management?") also confirms that CUE in general is no only an issue between student and lecturer.

The other results in this section speak for themselves. The overall conclusion must be that institutions generally emphasise quite strongly on CUE - and apparently see CUE as applicable tool for quality control. This fact compared with the low degree of documentation and transparency should be noted.

Table 3. Course unit evaluation (Q3.1 ÷ 3.13). Where answers require “YES” or “NO” designations 1 and 0 are used respectively thus making it possible to calculate (M)ean.

No	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.10	3.11	3.12	3.13
1	0		1	0	1	1	0	0	0	1	1	0	1
2	0		0	1	1	1	0	1	0	1	1	0	0
3	1	1	1	1	1	0	0	0	0	1	1	1	0
4	1	1	1	1	1	1	1	1	1	1	1	1	1
5	1	1	1		1	1	1	1	0	1	1	1	1
6	0		0				1	1	0	0	1	1	1
7	1		1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	0	1	0	1	1	1	0
9	1	1	1	1	1	1	1	1	1	1	1	0	0
10	1	1	1		1	1	0	1	1	1	0		1
11	1	1	1	1	0		0	0	0	0	1	0	0
12	1	1	1	1	1	0	0	1	1	1	1	1	1
13	0	0	0				0	0	0	0	0	0	0
14	0	0	0				0	0	0	0	0	0	0
15	0		0	0	1	1	0	0	0	1	1	1	0
16	0				1	1	0	1	1	1	1	0	0
17	1	0	1	1	1	1	0	1	0	1	1	0	1
18	1	0	1	1	1	1	0	1	1	1	0	1	1
19	0										0	0	
20	0	0	1	0	1	1	0	1	0	1	1	0	1
21	1	1	1	1	1	1	0	1	0	1	1	0	1
22	0		1	0	1	0	0	0	0	1	1	1	1
23	1	1	1	0	1	0	1	1	1	0	1	0	0
24	0						0	0	0	0	0	0	0
25	0		1	1	1	0			0				
26	1	1	1	1	1	1	1	1	0	1	1	1	1
27	1	1	1	1	1	1	1	1	1	1	1	0	0
28	1	1	0				1	1	1	1	1	0	1
M	0,57	0,69	0,76	0,74	0,95	0,76	0,35	0,69	0,37	0,77	0,78	0,42	0,54

4. Student Examination

Questions 4.1 through 4.5, on the form of examination used, do not have a strong impact on the judgement of Quality Management but compared with the other answers in this block they could render some useful information on this product parameter. It is, however, a possibility that some of the questions has been misunderstood by the responders. It is hard to believe that three of the institutions as a rule do not use a graded scale and one does not in 50 % of examinations. In many cases the total percentage exceeds 100; the explanation is clearly - as it also appears from several comments - that in many cases both written and oral examination is being used in the same course unit. Otherwise it can be seen that written examination (Q 4.3) is the most popular form and that oral examination (Q 4.5) is not often used. It can also be seen (at least implicitly) that group based learning is not so widespread (Q 4.4).

It is interesting to note (Q 4.6 and Q 4.7) that external examiners as a rule are not being used as part of external assessment - in spite of the fact that most of the institutions are subject to external examiner involvement (see Q 6.2).

Nearly four out of six institutions (Q 4.8), quite a high proportion, allow group based diploma projects. It is a little surprising that no interinstitutional correlation can be found to the response on Q 4.4 which stipulates the amount of group based learning as a total. All institutions claim to examine and grade group projects individually (Q 4.9). Since this factor can have some impact on student attitude and learning style, it should have been analysed in greater detail.

It appears that the questions 4.10 and 4.11 should have been asked in a different way ("certain examinations" could be just one or very few). There are only three strong NOs and the very clear YES to Q 4.11 could indicate that unlimited use of aids is quite widespread.

The response to Q 4.12: "Is it - de facto - the lecturer that decides the form and condition of a certain examination?" is a very clear YES. Since it can be assumed that the proceedings in this area always are very well documented, this indicates that the relations between level [1] and [2] as far as goals and policy are concerned could be very "loose" indeed.

It can be concluded that student examination in civil engineering education is planned and performed in a very "traditional" way. In this area the institutions have a great degree of freedom and a decisive part of this is controlled by the lecturers in question. This could indicate that the institutions (management) in general do not see student examination as a part of the product. As mentioned in the introduction these findings do not necessarily have any impact on the actual level of quality whatsoever. They merely confirm that the institutions in general do not make full use of this quality parameter, a statement that can be backed up by the response to Q 5.9, "... the relations between the objectives of course units and what is being measured by examination ..." (see below).

Table 4. Student Examinations. (Q4.1 ÷ 4.14) Where answers require “YES” or “NO” designations 1 and 0 are used respectively thus making it possible to calculate (M)ean.

No	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	4.10	4.11	4.12	4.13	4.14
1		10	50	35	5	0	0	1	1	0	1	1	0	0
2	5	2	80	18	0	0	0	1	1	0	1	1	1	
3	0	10	40	20	30	0	0	0	1	0	1	1	1	
4	0	0	75	10	2	0	0	1	1	0	1	1	1	
5	10	10	80	20	10	0	1	0	1	1		0	0	1
6	0	1	50	50	50	0	0	1	1	0	0	1		
7	0	0	30	30	40	1	0	1	1	0	1	1	1	
8	0	0	100	0	0	0	1	1	1	0	1	1	1	
9	0	0	66	1	0	1	1	1	1	0	0	1	1	1
10	5	10	90	5	5			0	1	0	1	1		
11	10	10	50	40	20	0	0	0	1	0	1	1	1	
12	50	50	100	15	0	0	0	0	1	1		1	0	0
13	0	0	90	10	0	0	0	1	1	0	1	1	1	
14	60	0	20	80	0	1	0	0	1	0	1	1	1	
15	0	20	80	15	5	0	0	0	1	0	1	1	1	
16	25	0	70	5	5	0	0	1	1	0	1	1	0	0
17	0	0	85	10	20	0	0	1	1	0	1	1	1	0
18	100	0	50	20	80	0	0	0	1	1		1	0	1
19	5	2	3	5	85	0	0	1	1	0	1	1	1	
20	0	10	40	40	10	0	0	0	1		0	1	0	1
21	20	0	34		10	1	1	1	1	0	1	1	1	0
22	5	0	80	15	0	0	0	1	1	0	1	1	0	0
23	8	4	50	35	8	1	1	1	1	1		0	1	
24	3	3	30	15	55	0	0	0		0	1	1	0	0
25	100	0	100		100	1	0	0		0	1	1	0	0
26	0	5	40	10	50	0	0	1	1	0	1	1	0	1
27	100	0	0	30	100	0	0	1	1	0	1	1	1	
28	95	5	25	10	60	0	0	0	1	0	1	1	0	
M	22,3	5,43	57,4	20,9	26,8	0,22	0,19	0,57	1,00	0,15	0,88	0,93	0,58	0,38

5. Quality Maintenance

85 % of the institutions (Q 5.1) are subject to external influence on curricula, at least to some extent. However, it can be read from the response to Q 5.2 that the degree is very low indeed, for 35 % the influence is in fact non-existing and for more than half of those the influence is 10 % or less. The response to Q 5.3 strengthens the fact that the influence is weak. From an "outside" point of view this could be seen as a very strong motive for assessment from an "outside" point of view and from an "inside" point of view for performing more proper quality management. The many "YES" to Q 5.1 followed by "100 %" faculty/department influence (Q5.2) can only mean that "de facto" influence is very high indeed.

The response to Q 5.4 is a little alarming: more than 50 % say planning of curricula is governed by staff available. Maybe the term "within your flexibility" in some cases has been mistaken for "when planning electives". Again, this does not necessarily mean low quality level, but it certainly means "steering" more by chance than by strategic pedagogic planning and the result could in many cases be a static, not progressive organisation. the fact that research results and research ability in many cases do govern appointment could also have a heavy impact on the response.

The response to Q 5.5, 5.6 and 5.7 show a fair amount of influence on syllabi from professional bodies, employers and former students. It is, however, a little surprising that the latter - perhaps most valuable and direct source of feedback on applicability of education imparted - is the weakest.

The weak relation "... between the objectives of course units and what is being measured by examinations ..." (Q 5.9) has already been mentioned. Furthermore, it can be concluded (Q 5.10) that only 50 % of those who claim to control this have a policy for dealing with discrepancies.

It is also mentioned earlier that the lecturer in civil engineering generally is very much on his or her own. The response to Q 5.11 underlines this; the use of collegiate supervision is not very common.

It can be concluded that quality maintenance is something the institutions are aware of but there is a very little degree of formalisation in this field, the response to Q 5.8 also directly underlines this.

Table 5. Quality Maintenance (Q5.1 ÷ 5.11) Where answers require “YES” or “NO” designations 1 and 0 are used respectively thus making it possible to calculate (M)ean.

No	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	5.10	5.11
1	1		0	0	1	1	1	0	0		0
2	1	100	1	1	1	1	1	0	1	1	1
3	1	90	0	0	1	1	1	1	1	0	0
4	0			0	1	1	1	1	0		1
5	1	100	0	0	1	0	1	0	1	1	1
6	1	40	0	0	1	1	0	0	0		0
7	1	100	0	0	1	1	1	0	0		0
8	1	90	1	1	1	1	1	0	0		0
9	1	40	1	0	1	0	0	1	1	0	0
10	1	0	0	1				0	1	1	0
11	1	25	0	1	0	0	0	0	0		1
12	1	80	0	1	1	1	0	1	0		0
13	1	90	0	1	1	0	1	0	0		0
14	1	100	1	0	1	1	1	0	0		1
15	1	100	0	0	1	1	1	1	1	0	0
16	1	100	0	0	0	0	0	0	0		0
17	0			1	1	0	0	1	0	1	0
18	1	15	0	0	0	0	0	0	0		0
19	1		0	0	0	0	0	0	0		0
20											
21	1	90	0	1	0	1	0	0	1	0	0
22	1	100	0	1	1	1	1	1	1	0	0
23			0	0	0	0	0	1	0		0
24	0			1	1	0	0	0	0		0
25	1	100			1	1			1		
26	0			0	0	0	1	1	1	1	1
27	1	30	0	1	0	0	0	1	0		0
28	1	75	0	1	0	0	0	0	0		1
M	0,85	75,6	0,20	0,46	0,65	0,50	0,48	0,38	0,37	0,50	0,27

6. Audit and Assessment

The first question in this block is on whether or not graduates can function in the profession without any other condition than having passed the final exam. It appears that only in very few cases this requires accreditation of the institution or the graduate obtain a charter or some sort of authorisation.

The survey does not go deeper into the question of authorisation of the institution and legal protection of titles and/or academic degrees. However, it must be assumed that in most cases the conditions of ability to function as an engineer is directly linked to "official recognition" of the institution.

Table 6. Audit and Assessment (Q6.1 ÷ 6.6) Where answers require “YES” or “NO” designations 1 and 0 are used respectively thus making it possible to calculate (M)ean.

No	6.1	6.2	6.3	6.4	6.5	6.6
1	1	1		0	0	0
2	1	1	5	0	1	1
3	1	1	5	0	1	1
4	1	1	10	0	1	1
5	1	1	5	1	1	1
6	0					
7	1	1	8	1		1
8	0	1	6	1	1	1
9	0	1	4	0	1	1
10		0			1	0
11	1	0			0	0
12	1	1	4	1	1	1
13	1		1			0
14	0	1	4	1	0	1
15	1	1	5	0	1	1
16	1	0				
17	1	1	5	0	1	0
18	1	0				0
19	0	1	5	1	1	0
20		1	4	1		0
21	1	1	5	0	1	1
22	1	0			0	0
23	1	0			1	0
24	1	0				0
25	1	0				
26	1	1	5	0		
27	1	0				
28	0	1			1	1
M	0,77	0,65	5,06	0,44	0,76	0,50

Questions Q 6.2 through 6.4 is on external assessment. It is clear that this element is quite common and since the question was tightened with "... with a certain frequency ..." and one "blank" mentions a frequency of one year, it can be assumed that 65 % of the institutions are subject to "governmental control". The frequency has an average of five years and in approximately half the cases ranking or grading is done.

A very large proportion of the institutions have the impression (Q 6.5) that external assessment would include an audit of its Quality Management Programme - if they had one. This indicates that many institutions find that more formalisation could prove useful in "dealing with" assessment.
50 % of the institutions claim to have a system for internal audit (Q 6.6). This question should have been followed up by an investigation of the depth of this.

7. Concluding Questions

The questions in this block are on the institution's future thoughts of or attitude towards a higher degree of formalisation of Quality Assurance and its maintenance. The response on this is quite clear; a very large proportion of the institutions have the intention to work on this.

One institution, however, has a different opinion and also a very non-committal approach on this issue. This is both interesting and a little confusing, since this institution claims not to "... have a formal Quality Management Programme as (or similar to) the one described in the Preliminary Paper ..." , nor is it the impression that it relies very much on formalised documentation. Since the institutions should remain anonymous no further analysis will be done on this (interesting) matter.

It is a very pleasant experience for Working Group B to discover (Q 7.3) that its work apparently has contributed considerably.

It appears that very few respondents thought that the questionnaire was not large or detailed enough, and on the whole very few extra remarks were given.

This survey is not state-of-the-art. Still it is the hope of Working Group B of the EUCEET project that it has contributed positively to the future discussion of the important question of how to manage quality in civil engineering education. It is also the impression that the results of the survey is equally relevant for engineering education in general and to a large degree for all higher education.

Table 7. Quality Maintenance (Q5.1 ÷ 5.11) Where answers require "YES" or "NO" designations 1 and 0 are used respectively thus making it possible to calculate (M)ean.

No	7.1	7.2	7.3	7.4	7.5
1	1	1	1	1	0
2		1	1	1	0
3		1	1	0	0
4		1	1	1	0
5	1	1	1	1	1
6		1	1	1	
7	1	1	1	1	0
8	1	1	1	1	0
9		1	0	1	0
10	1	1		1	
11	1	1	1	1	1
12	1	1	1		1
13	1	1	1	1	0
14		1	1	1	0
15		1	1	0	0
16	1	0	1	1	0
17	0	0	1	1	0
18	1	1	1	1	1
19	1	1	1	1	0
20	1	1	1	1	0
21				1	0
22		1	1	1	0
23		1	1	1	0
24	1	0	1	0	0
25		1	1	1	0
26	0	0	0	0	0
27	1	1	1	1	
28	1	1	1	1	0
M	0,87	0,85	0,92	0,85	0,17

Appendix 1

Questionnaire

1. Quality Management and Organisation

1.1 As an overall reflection, is it your impression that your institution runs and maintains a formal Quality Management Programme as (or similar to) the one described in "Preliminary Paper".does your institution have a written goal formulation? YES ___ NO___

1.2 In many cases - especially in section 2 of this questionnaire - it is important to know the organisational level in question. For simplicity this questionnaire only deals with the three lowest levels. Level 1 is course unit level. A course unit is any specified part of a course given (a number of lectures, "subject", "discipline", lab exercise, field course, project, etc.). Please describe your organisation by ticking the labels you think fit best level by level or write what you feel fits best:

1st level[1]	2nd level [2]		3rd level [3]	4th level
course unit	□ department		□ faculty	□ university
	□ section	□ department	□ school	□ institute
	□ faculty	□ university	□ institution	
	□ institute		□ college	
	□		□	□

2. Quality Assurance

With reference to "Preliminary Paper's" section on "Quality Assurance Structure", see also figure 1 of that paper,

2.1 does your institution have a written goal formulation?
[1] YES ____ NO ____ [2] YES ____ NO ____ [3] YES ____ NO ____
2.2 does your institution have written quality measures?
[1] YES ____ NO ____ [2] YES ____ NO ____ [3] YES ____ NO ____
2.3 does your institution have a written strategy for quality maintenance?
[1] YES ____ NO ____ [2] YES ____ NO ____ [3] YES ____ NO ____
2.4 does your institution have a written staff policy?
[1] YES ____ NO ____ [2] YES ____ NO ____ [3] YES ____ NO ____
2.5 do you have a written policy on the introduction of new lecturing staff?
[1] YES ____ NO ____ [2] YES ____ NO ____ [3] YES ____ NO ____
2.6 do you have a written policy on international relations?
[1] YES ____ NO ____ [2] YES ____ NO ____ [3] YES ____ NO ____
2.7 do you have a written policy on IT?
[1] YES ____ NO ____ [2] YES ____ NO ____ [3] YES ____ NO ____
2.8 What is - at level [2] - your student/PC ratio? _________

2.9 Regarding the balance between focussing on basic and traditional engineering theory and focussing on the graduates' ability to work with engineering routines, do you have a written policy on this balance?
[1] YES ____ NO ____ [2] YES ____ NO ____ [3] YES ____ NO ____
2.10 If YES to 2.9, do you think you have succeeded in working this out in clear cut, operational quality measures? YES ____ NO ____
2.11 Assuming that a description of the content of course units are mandatory, does each course unit in your course(s) have a written goal description?
YES ____ NO ____
2.12 Is it, for each course unit - not only implicitly by judging content and textbooks used - but directly by listed quality measures, possible to judge the academic and/or the practical level aimed for? YES ____ NO ____
2.13 Is it, for each course unit, mandatory for the lecturer in charge to produce and publish a detailed study plan making it possible to monitor closely the content and distribution of lectures, coursework, home work, use of examples, group work, projects, etc.? YES ____ NO ____
2.14 Is it, for each course unit, mandatory for the lecturer in charge to make this documentation accessible for all interested parties?
YES ____ NO ____
2.15 Is it, for each course unit, mandatory for the lecturer in charge to make the documentation accessible in electronic form, via a department intranet or similar? YES ____ NO ____
2.16 Is it, for each course unit, mandatory for the lecturer in charge to produce - and to publish - a set of examples and problems designed to be used as examples and home work in the course? YES ____ NO ____
2.17 If YES to 2.16, is it mandatory to show how examples and problems used as home work are linked to elements in the study plan?
YES ____ NO ____
2.18 If NO to 2.16, does your policy allow random use of examples and of problems used as home work? YES ____ NO ____
2.19 If NO to 2.16, does your policy allow - in other course units than those covering basic subjects - random use of old exam problems?
YES ____ NO ____

3. Course Unit Evaluation

Course Unit Evaluation (in the following abbreviated CUE) is here defined as students' evaluation of content of, methods used in a course unit and other pedagogic and professional parameters of a course unit, be it a taught course, project work, coursework, field course, etc. (see more detailed description and discussion of CUE in "Preliminary Paper")

3.1 Is it a rule or a very strongly governed principle that all course units be subject to CUE? YES ____ NO ____

If NO to 3.1, jump to question 3.3

3.2 Do you have a written or otherwise strongly manifested policy on How CUE should be performed? YES ____ NO ____

3.3 Is using a questionnaire mandatory/normal procedure? YES ____ NO ____

3.4 If YES to 3.3, is a standard questionnaire being used? YES ____ NO ____

3.5 If YES to 3.3, are students anonymous to the educator? YES ____ NO ____

3.6 If YES to 3.3, are students totally anonymous? YES ____ NO ____

3.7 Is it mandatory that a written conclusion is made of each CUE? YES ____ NO ____

3.8 Is it normal procedure that results of CUEs are submitted to management? YES ____ NO ____

3.9 Is it normal procedure that results of CUEs are published and made accessible to all interested parties? YES ____ NO ____

3.10 Is it normal procedure that CUEs are performed only when course units are completed or nearly completed? YES ____ NO ____

3.11 Do you - in CUEs - intend to measure parameters others than pedagogic ones, such as content, relevance, academic level, cohesion with Other subjects, etc. YES ____ NO ____

3.12 Is CUE used for other purposes than Quality Management, i.e. staff evaluation with certain consequences? YES ____ NO ____

3.13 Do CUEs include evaluation of examination procedures? YES ____ NO ____

4. Student Examination

%

4.1 What percentage of your course units are evaluated using passed/failed?

4.2 What percentage of your course units are evaluated by attendance only?

4.3 What percentage of your course units are evaluated using written examination?

4.4 What percentage of your course units are evaluated using oral examination based on a submitted paper, project report, etc.?

4.5 Which percentage of your course units are evaluated using traditional oral examination?

4.6 Is it, in your situation, normal procedure that external examiners can comment on and should confirm problems used for student examination?

4.7 Is it, in your situation, controlled by government or another external body mandatory that external examiners must file reports on the course of examinations they participate in? YES ____ NO ____

4.8 Do you allow final or diploma projects based on group work? YES ____ NO ____

4.9 In the case of group based learning, do you examine and grade individually? YES ____ NO ____

4.10 In the case of written examination, do you always allow unlimited use of aids, such as textbooks, worked examples, notes, programmable pocket calcs.or PCs, etc.? YES ____ NO ____

4.11 If NO to 4.10, do you allow all aids in certain examinations?
YES ____ NO ____
4.12 Is it - de facto - the lecturer that decides the form and conditions of a certain examination? YES ____ NO ____
4.13 Do you run a modular system where students - with or without prerequisites - can attend and should pass exams individually? YES ____ NO ____
4.14 If NO to 4.13, does passing exams mean obtaining a certain average grade in a semester's, year's or a string of course units? YES ____ NO ____

5. Quality Maintenance

5.1 Is your curricula - to some extent - controlled by legislation, administered by government, ministry, assessment and/or accreditation bodies?
YES ____ NO ____
5.2 If YES to 5.1, which percentage is (or do you think is) controlled by the faculty or department? YES ____ NO ____
5.3 If YES to 5.1, does the control go as far as to influence syllabi in detail?
YES ____ NO ____
5.4 Within your flexibility in change of curricula, is your choice of content to a great extent governed by staff available? YES ____ NO ____
5.5 Do you have a policy on - with a certain frequency - to discuss your syllabi with and/or to ask for comments on your syllabi from professional bodies or individuals in the profession? YES ____ NO ____
5.6 Do you have a policy on - with a certain frequency - to discuss your syllabi with and/or to ask for comments on your syllabi from employer associations or individual employers? YES ____ NO ____
5.7 Do you have a policy on having former graduates to comment on your syllabi?
YES ____ NO ____
5.8 Apart from Course Unit Evaluation and examinations, do you have any formal (written) policy of how to maintain quality? YES ____ NO ____
5.9 Do you have a firm and manifest policy for the relation between the objectives of course units and what is being measured by examination? YES ____ NO ____
5.10 If YES to 5.9, do you have a strategy for dealing with discrepancies?
YES ____ NO ____
5.11 In case of insufficient quality at course unit level, do you have a routine for using collegiate supervision? YES ____ NO ____

6. Audit and Assessment

For definitions, please read "Preliminary Paper". Chapter 9 of this paper, "Audit" also gives a short description of the distinction between the two concepts.

6.1 Can graduates from your institution obtain membership of your national associasion of professionals and/or can they function as engineers without your institution having been accredited by a professional body? YES ____ NO ____

6.2 Is your faculty/department subject to a mandatory external assessment performed with a certain frequency? YES ____ NO ____

If NO to 6.2 jump to question 6.5

6.3 If YES to 6.2, what is the frequency? _____year(s)

6.4 If YES to 6.2, will you be graded or ranked? YES ____ NO ____

6.5 If you have a Quality Management Programme as described in "Preliminary Paper" or similar (if YES to 1.1), is it then your impression that an audit of this was (or will be) included in the assessment? YES ____ NO ____

6.6 Do you have a policy for and a strategy on how to implement and run internal audit as defined in "Preliminary Paper"? YES ____ NO ____

7. Concluding Questions

7.1 If you do not have a formalised and detailed Quality Management Programme (if NO to 1.1), would you then intend to develop and - in the near future - work on an implementation of one? YES ____ NO ____

7.2 Is it your impression that the existence of an efficient and detailed Quality Management Programme has improved (or would improve) the future conditions for your institution/faculty/department? YES ____ NO ____

7.3 Is it your impression that the contributions of Working Group B in the EUCEET Thematic Network i.e. "Preliminary Paper" and the results of this survey has given and/or will give you new ideas in the field of Quality Management?
YES ____ NO ____

7.4 Is it your impression that the existence of an efficient and detailed Quality Management Programme can improve your "control over" external Assessments?
YES ____ NO ____

7.5 Are there other questions you think we should have asked in this questionnaire?
YES ____ NO ____

PART FOUR

REPORT OF THE
WORKING GROUP C

Synergies between Universities, Research, Industry and Public Authorities in the Construction Sector of Europe

Synthesis of Activities Undertaken by the Working Group C

Synergies between Universities, Research, Industry and Public Authorities in the Construction Sector of Europe

Laurie BOSWELL
City University London (UK)
Colin KERR
Imperial College London (UK)
Ralf REINECKE
T.U. München (DE)

II SYNERGIES BETWEEN UNIVERSITIES, INDUSTRY AND PUBLIC AUTHORITIES IN THE CONSTRUCTION SECTOR OF EUROPE

Laurie BOSWELL - City University London
Colin KERR - Imperial College London
Ralf REINECKE - T.U. München

1. Analysis of the results

In analysing the questionnaires, we have attempted to quantify results as much as possible, and have presented data primarily in the form of bar charts. Thus, in many cases, respondents were asked to score the importance of certain factors on a scale of 0-5 and these results are often shown as averages, in the form of bar charts, throughout this report. Respondents also had the opportunity to comment freely, and a summary of these comments is also included. These cannot necessarily be said to be representative or statistically significant, but they do give a good indication of the issues which concern some members of EUCEET.

In undertaking the analysis and preparation of the report, certain issues became apparent, which should be borne in mind when drawing conclusions. Firstly, 6 Universities/Institutions specialise in aspects of civil engineering, such as geotechnics, hydraulics, etc, and as such their opinions probably only reflect part of the whole picture. Secondly, though not stated explicitly, it seems to be the case that some Universities give a very high priority to research, others are essentially teaching institutions, and some have a good balance. It is likely that some responses reflect this balance of interests. Thirdly, not everyone answered every question fully or clearly, so some interpretation of replies has been necessary. Finally, despite the effort which went into the drafting of the questionnaire, it became apparent when looking at responses that different Universities sometimes interpreted questions in different ways, and this has had some effect on the interpretation and presentation of results. Having noted these points, we still take the view that the study has led to some worthwhile observations and conclusions.

2. Teaching links (SECTION 0.2)

This section attempts to establish the types of external links which operate in Universities. Respondents were asked to indicate their degree of involvement with Government, Public Bodies, Industry, International and National organisations, to describe these activities and to indicate the number of external staff involved.

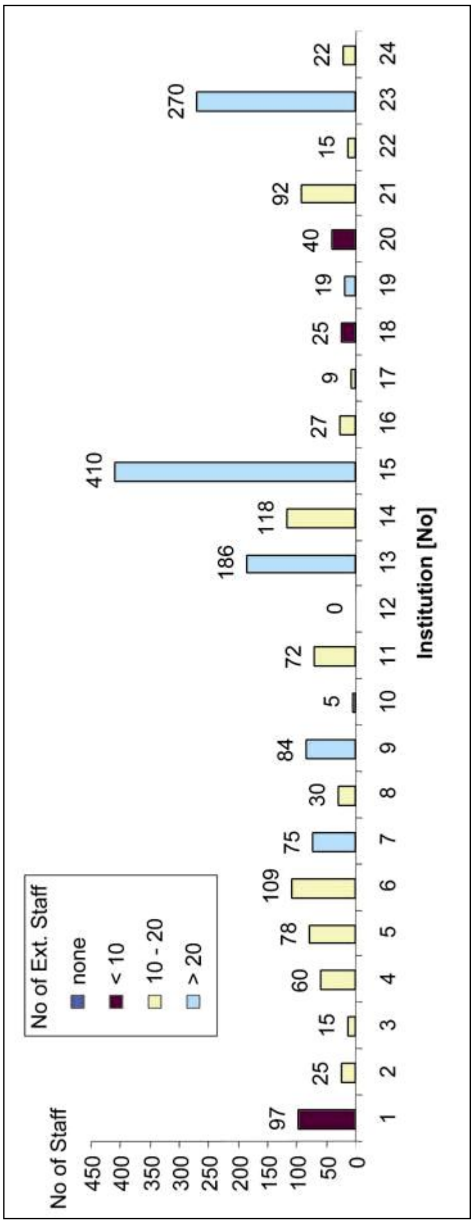

Figure 1. Number of permanent university staff (shown as bar heights) compared to numbers of external staff (shown by shading)

The information provided by the questionnaire shows that all Universities have some teaching links and that most regard these as relatively important. Practically all respondents report links which involve Government, Public Bodies and Industry. All except one claim international teaching links. Teaching support is provided in most subject areas, with some emphasis on the design and professional subjects, which is to be expected. Figure 1 shows the number of external staff involved in teaching, compared with the number of permanent staff. The height of each bar represents the number of permanent staff and the shading indicates the numbers of external staff. Figure 2 shows the overall percentages of external staff for the survey as a whole. The phrase 'external staff' is taken to mean all those not holding a contract of employment with the University.

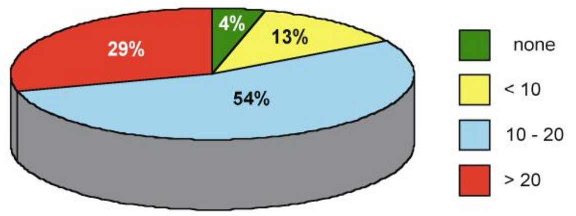

Figure 2. Numbers of external teaching staff for the survey as a whole

The questionnaire also gave respondents the opportunity to indicate the relative importance they give to links with different sorts of organisations, by scoring them on a scale of 0-5. The average scores are shown in Figure 3, which shows the relative importance placed by universities on their teaching links with various types of external bodies, and it can be seen that involvement with Industry and National Organisations is more important than with, for example, Government and Public Bodies**.**

Although not part of this study, it is recognised that some Universities will have formal periods where students are placed in Industry, such as stages scientifiques, sandwich placements and so on. Working Group C did not attempt to evaluate these, feeling that this was a task within the remit of Working Group A.

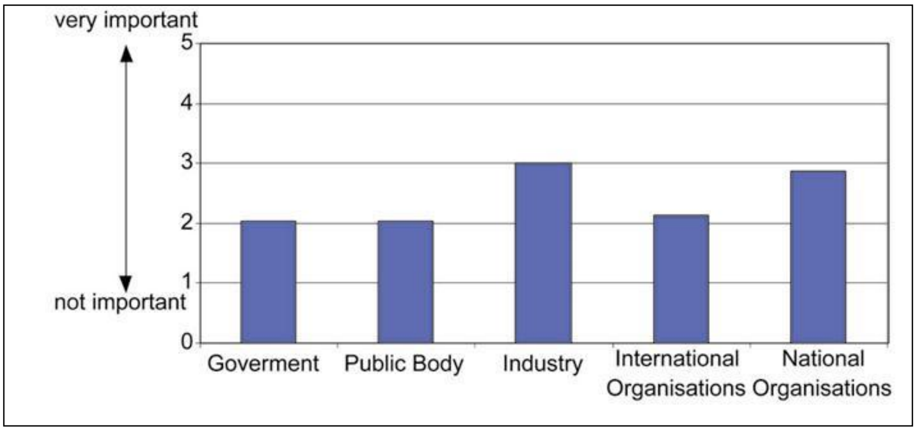

Figure 3. Relative importance to Universities of teaching links with different types of external organisations (0.2.)

3. Research links (SECTION 0.3)

This section shows that Universities have links with many types of organisation, from Government to Industry. Data in this Section has been scored in the manner indicated above, and Figure 4 shows the relative importance perceived by respondents of research links with different types of external organisations. Although the range is not great, it can be seen that the most important links are those with Industry and Research Institutes.

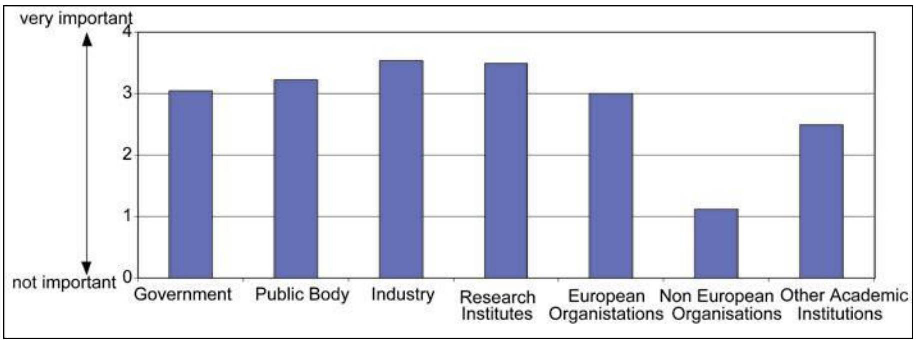

Figure 4. Relative importance to Universities of research links with different types of external organisations (0.3.)

The links often reflect geographical or historical political influences such as, for example, Spanish and Portuguese University links with South America. The emerging economies of the former eastern European countries have made industrial links with local universities more recently and these are not yet widespread. It is known from sources outside the questionnaire that many European Civil Engineering Departments are involved in research programmes funded by the European Union. The questionnaire provides supporting evidence of this.

4. Areas of link activity in teaching (SECTION 0.4)

Section 0.2 in the questionnaire has established that in general, a wide range of external organisations provide Universities with specialist teaching and that links between these organisations and the Universities are good. Section 0.4 considers the types of material and subjects covered in more detail. From this it was clear that the range of subjects covered includes most which would be expected, for example, structural mechanics, fluid mechanics, geotechics, materials, design, transport, environment and so on.

In 6 responses, where the institution represents a limited subject area, such as structural engineering or geotechnics, the links are restricted to those specialisations.

The number of contact hours for a typical academic year varies very widely between Universities, to the extent that it is not easy to talk of an average. One has virtually no provision of teaching support from external sources, while a few have up to 250 hours per year. Figure 5 groups Universities according to the input of contact hours made by external staff. The range is wide, but the most common contribution is of the order of 50-100 contact hours per year.

Typically, a range of between 1 and 6 external organisations are involved with each main subject. However, it was not possible to determine from the questionnaire whether a single external organisation provided assistance in more than one subject area.

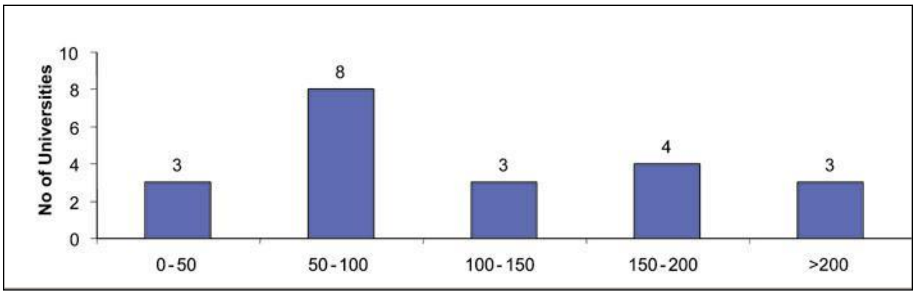

Figure 5. Contact hours of external staff/ academic year

5. Areas of link activity in research (SECTION 0.5)

Once again, the survey demonstrates that the research link between Universities and industry are good. Most of the traditional subjects such as structures, hydraulics and geotechnics, for example, involve strong links. Clearly, some institutional specialisation was reflected in the response. All but 2 respondents claim links in every discipline in which they have academic staff and the main types of collaboration are in areas such as in joint research projects, seminars and joint publication, as might be expected. Most Universities stress the importance of external funding for research. Numbers of external staff involved in such links are typically of the order of 10-40, but there are a number of cases where numbers are very much higher.

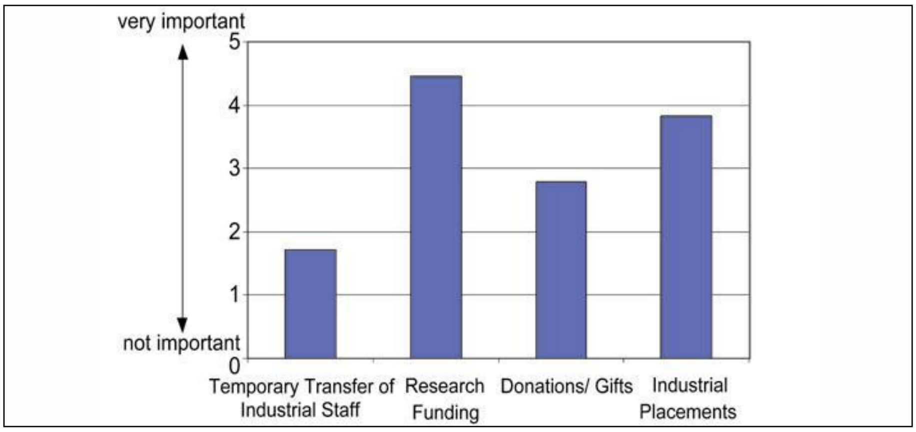

Figure 6. Relative importance to Universities of different type of involvement of outside bodies (0.6.2)

Figure 6 shows the type of activities involved in research links with external bodies and their relative importance. This has been established by the same type of scoring system indicated above, and it can be seen that externally funded contract research is the most important activity. Figure 7 compares the number of external staff involved in these links with the number of permanent University staff.

6. Involvement of outside bodies (SECTION 0.6)

This section deals with the contribution of outside bodies to the work of the University Department. The term outside bodies is taken to mean non-university organisations such as Companies, Research Institutes, Professional Organisations and Government Agencies.

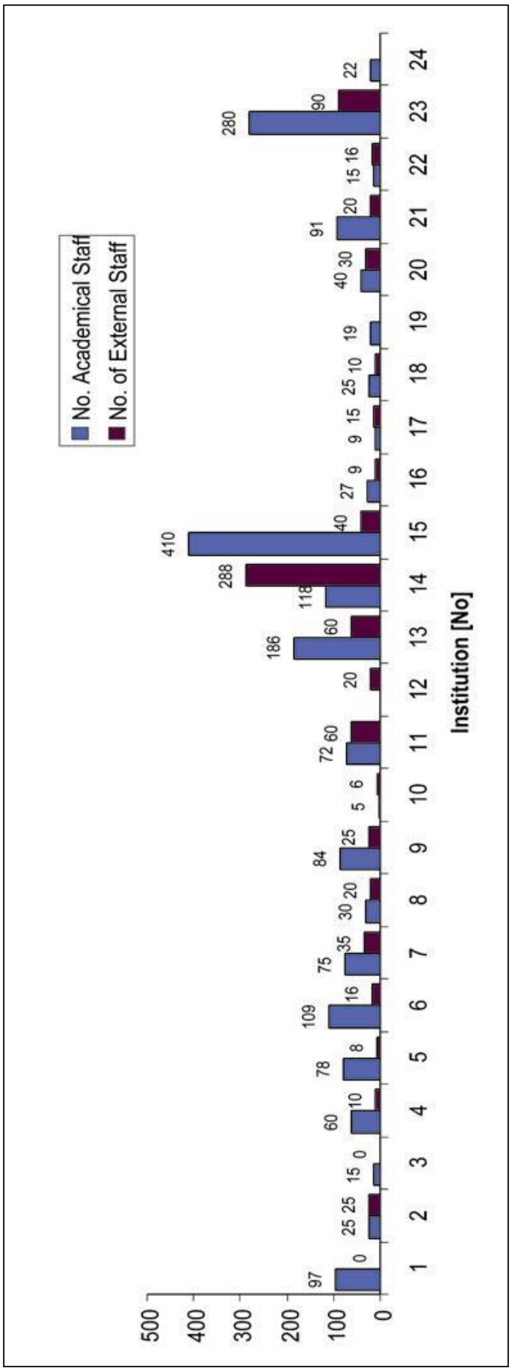

Figure 7. Numbers of permanent staff compared to numbers of external staff involved in research links

The role of Advisory Bodies for teaching and for research has been investigated, though no clear pattern has emerged from the returns. Some Universities have an Advisory Committee for teaching but not for research, or vice versa. Others have both and some departments have neither. However, the presence or absence of such bodies appeared to be independent of the relatively strong links which have been formed. Working Group C takes the view that the lack of a systematic pattern in the use (or not) of Advisory Committees probably reflects national mores, that is, it is expected in some national education systems but not in others.

Figure 8 shows the percentages of Universities having Advisory Committees, sponsored posts and part time lecturers**.** It can be seen from the data that there is a fairly even spread. The majority of universities (75%) have part time lecturers, and the range of external staff involved is large, from 5-60. Sponsored posts are found in 38% of Universities, though the number of these is usually small, between 1 and 5, and a similar percentage has Advisory Committees for teaching and/or research.

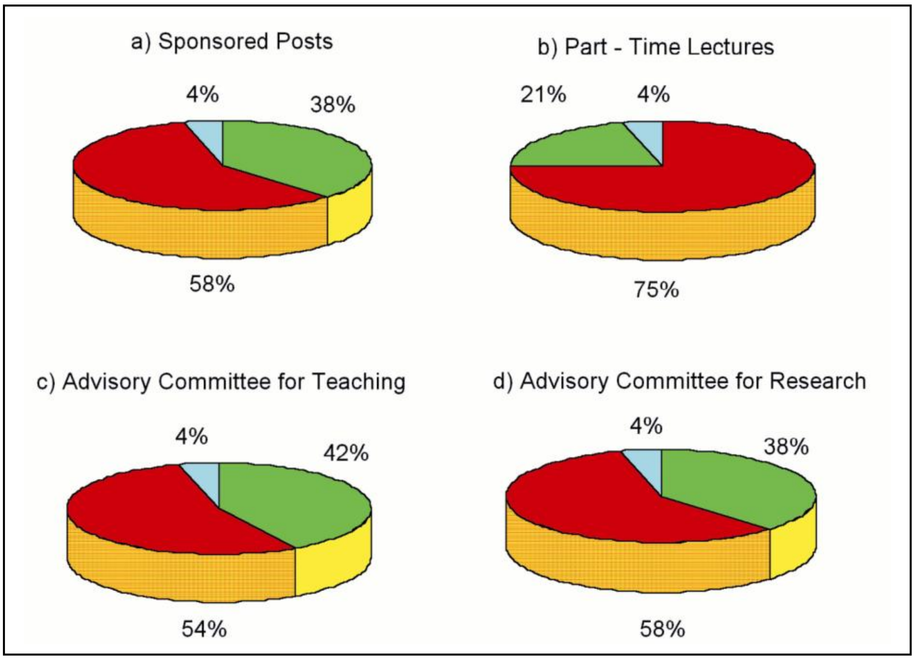

Figure 8. Percentages of universities having sponsored posts, part time lecturers and Advisory Committees

Most University Departments recognise the positive benefits of external involvement in their activities, as can be seen from Figure 9. Again, the same scoring system has been employed, giving an indication of the importance of certain types of involvement as perceived by the University. This figure shows the average situation, from which the importance of external link for obtaining research funds and of industrial placements for students can be seen.

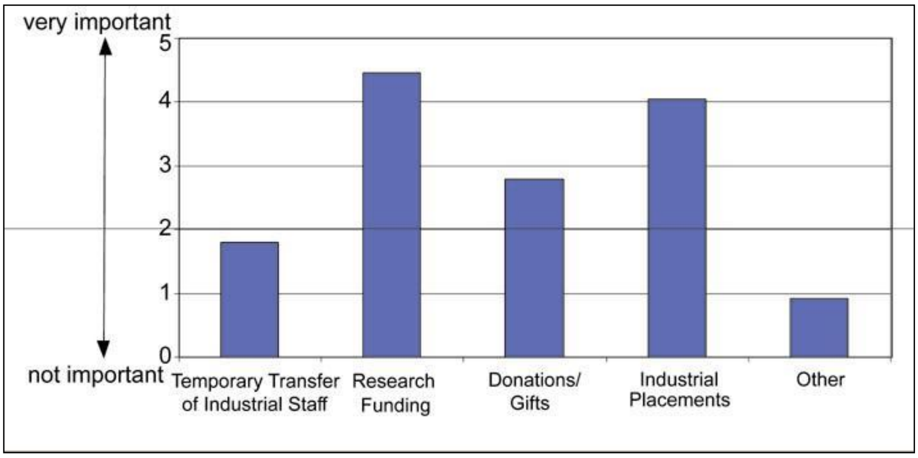

Figure 9. Types of activity involved in research links and their relative importance

In this bar chart, 'Industrial Staff' refers to the temporary transfer of industrial staff to the University, and 'Placements' refers to companies providing students with the opportunity to have a short placement with them to gain industrial experience.

7. Involvement of your institution with outside bodies (SECTION 0.7)

The questionnaire set out to establish the type of involvement that academic staff had with outside bodies or organisations, and details are shown in Figure 10. Although most Universities are active, the type of activity varies. Secondments of staff to Industry are quite common and considered fairly important, though a number of Universities have no secondment activity. Providing lectures and short courses for industry is also fairly important. Consulting, membership of technical committees and collaborative research are considered much more important.

Institutions were also asked to cite any other important involvement. The score for this section was 3,88, and the overwhelming factor cited here was the importance of EU/SOCRATES links.

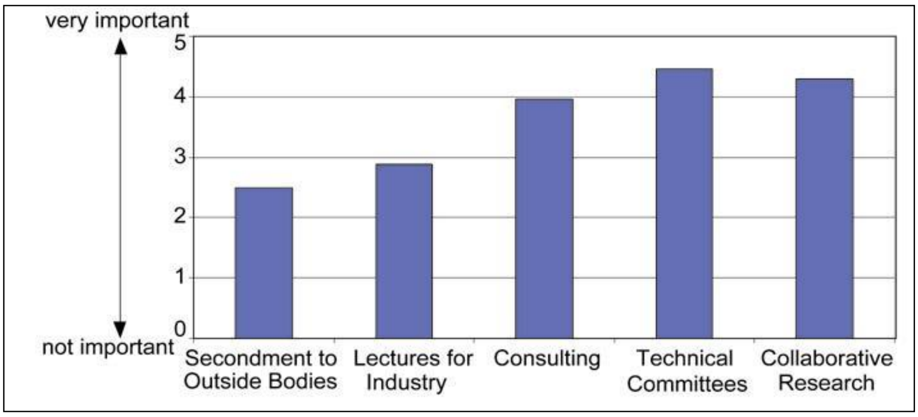

Figure 10. Types of involvement academic staff have with external bodies and their relative importance (0.7.)

8. Benefits of synergies (SECTION 0.8)

It is clear from the survey that all Universities agree that there are considerable benefits to students, academic staff and Industry as a result of their various link activities. Data on this is shown in Figures 11-13**.** The results indicate that synergies are seen to be of most benefit to students. Universities agree that student sponsorship, contact with industry during studies and job opportunities are the most important factors. Opportunities for vacation work are also important. Provision of an industrial mentor for a student or group of students is not considered to be particularly important. However, the Working Group are not sure that the idea of a mentor was properly understood and took the view that the poor score might reflect this. A better perspective on this point might be provided by asking students.

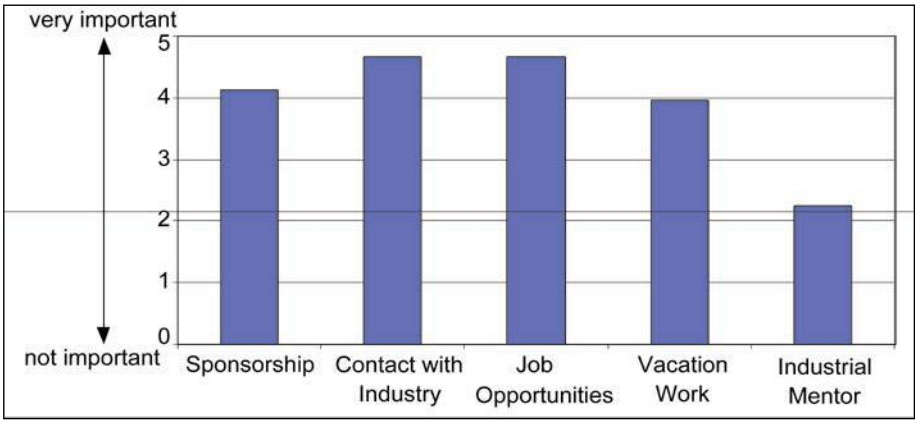

Figure 11. Types of benefits for the students due to a collaboration and their relative importance (0.8.1)

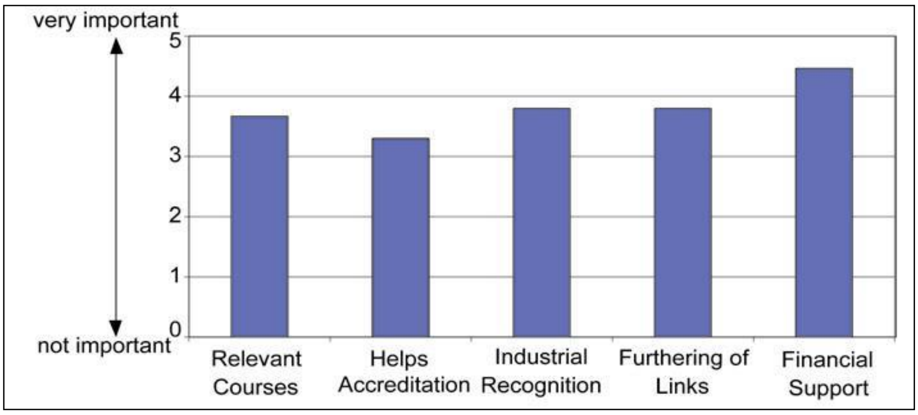

Figure 12. Types of benefits for the academic staff and institutions due to a collaboration and their relative importance (0.8.2)

A number of benefits to individual academic staff in particular, and to Universities in general, can be demonstrated. It is felt quite strongly that links lead to better financial support, make courses more industrially relevant, further/develop links generally, and promote wider recognition by Industry. Assistance with accreditation is also quite important, but not as much as the other factors. Universities were given the opportunity to cite other benefits for academic staff. In this regard, 30% said that consultancy was very important and a further 26% referred to networking, professional recognition, interaction with Government and knowledge transfer.

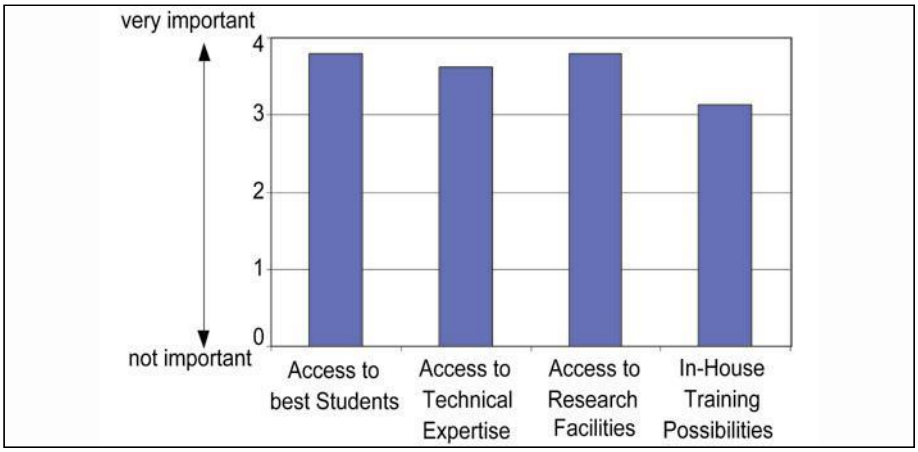

Figure 13. Types of benefits for the industry and the public sector due to a collaboration and their relative importance (0.8.3)

Responses seem to indicate that benefits to Industry are not so strong as those to Universities. In general, scores are lower than the results for students. Access to technical expertise and in-house training possibilities are certainly lower, though the possibilities of early selection of the best students and access to university research facilities are of comparable importance. It should be stressed that almost all the questionnaires were completed by academic partners so the perception of benefits to Industry needs to be considered in this light. It is expected that Working Group F will seek a more detailed response from Industry and the Profession at large on these matters.

9. Statements regarding the impact of synergies

In addition to asking for factual statements, respondents were given the opportunity to make general statements about their links, how they were established and any other relevant matters not covered in the questionnaire. In considering these, some common themes emerged, and some Universities clearly had problems or issues which are specific to them. We have attempted to cover all the issues raised and to indicate how widespread they are. The following section is a summary of views and issues raised, not a thorough analysis.

10. Problems and difficulties (SECTION 0.9)

These fell into several categories

a). **Technical and commercial needs**

Many Universities stress that the aims, needs and requirements of Industry are often different from those of the University and that this can cause difficulties in collaboration. Industry often has immediate problems to solve, and therefore may have a short term view of its needs. This often makes it difficult to persuade Industry to take an interest in and provide funding for fundamental work. Universities can and should take a longer view, furthering the development and fundamental understanding of the discipline. Two participants say that an over-emphasis on solving industrial problems can sometimes divert effort away from fundamental research, and two others say that quite often, Industry neither has interest in fundamental research nor appreciates the importance of applied research. One respondent is concerned that Universities should not compete against private consultancies. Another issue is that peaks and troughs in requests from Industry sometimes make it difficult to provide continuity of employment of research and technical staff. In some cases the expertise of University staff is not appropriate to tackle nationally defined priorities, which are often very difficult to establish anyway.

In addition, complex industrial tasks do not always lead to a well defined research project.

b). **Timescale**

Several Universities say that the timescales required by Industry are often very tight, and do not fit in with the way universities work. In some cases, this can mean that Universities turn down industrial projects. Sometime, there have been problems because University staff have been unable to meet industrial deadlines.

Although not reflected in the questions asked, some members of Working Group C feel that national Governments are sometimes partly responsible for not helping to reduce, and in some cases actually generating, short term thinking on the part of Industry.

c). **Economics**

Some Universities, particularly in Central and Eastern Europe, point out the difficulties caused by the poor economic situation in their countries. For example, in one case, Universities, Research Institutes and Industry are in a state of flux because many reforms are under way, and this lack of stability makes it very difficult to build links. Furthermore, lack of finance, inertia remaining from previous times, lack of modern facilities and lack of appropriate recognition for Engineers make it difficult to develop the Profession. In several countries, by no means confined to Central and Eastern Europe, Industry is facing severe financial problems, which limits the scope for developing long-term interest in research and of building links with Universities.

d). **Confidentiality**

Commercial confidentiality can be a problem; for example, some participants report cases where collaboration with certain companies would have resulted in restrictions on publication, and in another case, University regulations make collaboration with Industry difficult

In some Universities consultancy is not covered by insurance, but in others this is not a problem.

e). **Students and teaching**

Several Universities point out the difficulties which might arise from the variable quality of external teachers, in terms of management, pedagogical style and lack of tutorial support for students. Others say that however good industrial lectures may be, students might not take them seriously if they are not required for examination assessment.

Some contributors stress the importance of industrial links in assisting students with vacation experience and job opportunities, and one points out that that up to 30% of final year projects take place in Industry. Several contributors underline the importance of the Industry working with the University sector to present a positive image of the Civil Engineering Profession to the general public.

Some Universities are concerned about the cost of employing external lecturers, while others are sufficiently well staffed not to need extra contributions, even though this means the lack of important industrial experience. One contributor, while stressing the importance of industrial links, points out that this can lead to staff having difficulty distributing their time between teaching and industrial research.

12. How were links originally established? (SECTION 0.10)

Not surprisingly, most contributors say that links were primarily developed by personal contact, though some have resulted from a variety of other channels, such as EU databases, reputation of the Institution, influence of scientific publications, involvement in professional associations and organisations, and the role of alumni in the Industry.

Although links are mainly based on personal contacts, whether developed individually or through some of the other channels indicated above, and although specific projects are managed technically by individual academic staff, most Universities have a centralised administration for handling the finance, contractual and legal side of the work. One has a Professional Council which approves individual projects. Some Universities have extended these personal contacts by establishing more formal organisations such as industrial forums and twinning arrangements.

13. Any other points? (SECTION 0.11)

A least one University reported difficulty in collecting information from the whole Faculty, with the result that their questionnaire might only represent a partial view. This is a point which has been raised by, for example, several German universities during meetings of the Working Group.

Several Universities refer to the importance of promoting or marketing their competences to Industry. In general, this has had low priority in the past, and in some cases was not normal practice, but it is now becoming increasingly important as a means of building links.

Although not covered by the questionnaire, one University points out that some teaching and research collaboration is provided by other University Departments. This is almost certainly a widespread feature.

14. Conclusions, recommendations and other comments

As has been indicated earlier, this report represents the views of the academic community and should not be seen as a statement of Industry's opinions. However, those completing the returns are in a position to establish the facts, and because they generally work closely with industrial colleagues, they are to some extent mindful of their opinions. Having said this, the following **CONCLUSIONS** arise clearly from the work done so far:

- Good and extensive links exist between Universities and Industry, Research Institutes, Government and Public Bodies.

- These are clearly valued highly by the Universities and Research Institutes who are members of EUCEET, but we do not have the information to comment on the views of Industry, Government and Public Bodies.

- The links are widespread on the teaching front, and somewhat stronger in research

- The links seem to be most beneficial for students

- Despite the care taken in preparing the questionnaire, it is possible that there has been some misinterpretation and in retrospect, we might have added further questions to clarify certain points. However, we do not feel that this invalidates the broad picture which has emerged.

There are several **RECOMMENDATIONS** on how work could be developed. For example:

- Some reminders to participants had been issued, and it was noted that a number of Universities had promised, but not yet provided, a response. It was felt that a further reminder be issued, and that some effort should put into obtaining responses from at least 4 key Universities. Although this would mean reworking the data, there was no reason to expect a large change in the overall conclusions. However, replies from a number of key Universities would give the report more comprehensiveness.

- We believe that this report could well be of use to Working Group F, whose terms of reference lead on from this work in a number of ways. For example, there is scope for a study on the views/needs of Industry itself.

- Later on in the work of EUCEET, we could consider how to take positive steps to improve synergies and develop closer links with Industry, making the involvement more successful for both parties. Industrial views on how these synergies might develop should also be considered. This point was stressed by the Working Group.

- Consideration should be given to developing a benchmark for the way Universities and external bodies should collaborate, to define an 'ideal department' in terms of how it interacts with external organisations such as Industry, Research Institutes, and Government/Public Authorities.

Several **OTHER ISSUES** arose from debate within the Working Group, which are worthy of further consideration within EUCEET:

- We should consider carefully how to disseminate the results of this (and other) Working Group reports. This is primarily a matter for the Steering Group.

- The poor response to the role of industrial/external mentors for students surprised some Working Group members, who believed that the concept and role of mentors may have been poorly understood by those completing the questionnaire. It was suggested that we might try to develop ways to strengthen this sort of educational activity.

- Careful consideration should be given to the matter of what should be done about the completed questionnaires. Although it makes sense to include a blank questionnaire as an annexe to this report, it is the view of the Working Group that completed forms should not be published. However, it is recognised that they will need to be available, for example, to the SOCRATES Office, if required.

- Two important matters were raised, more in discussions of the Group than in the questionnaires themselves. The first is the rather poor image of the civil engineering profession, and how this might be enhanced, or at least reflected fairly in public opinion. The second is the need to present information about civil engineering in schools, both to encourage pupils to consider entry to the Profession and as a public information exercise, to ensure that the role and importance of the civil engineer is properly understood.

Average Score of importance for each factor (0.3.)

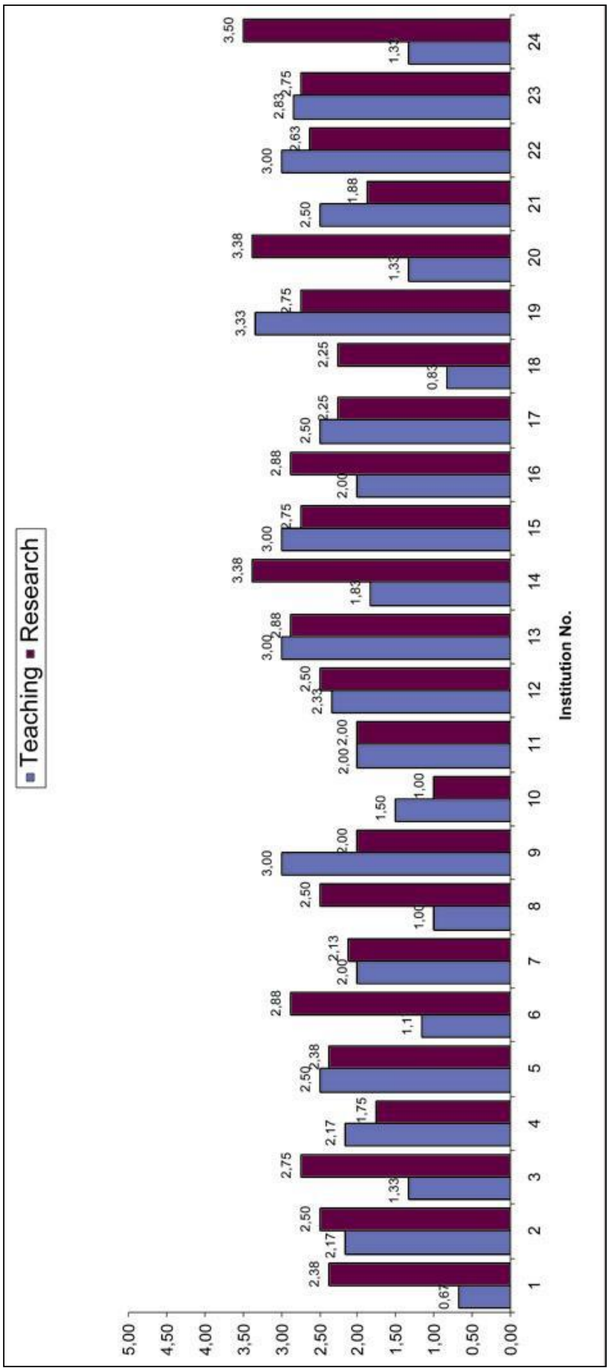

Figure 14

Importance of the synergy between industry and teaching (0.3.)

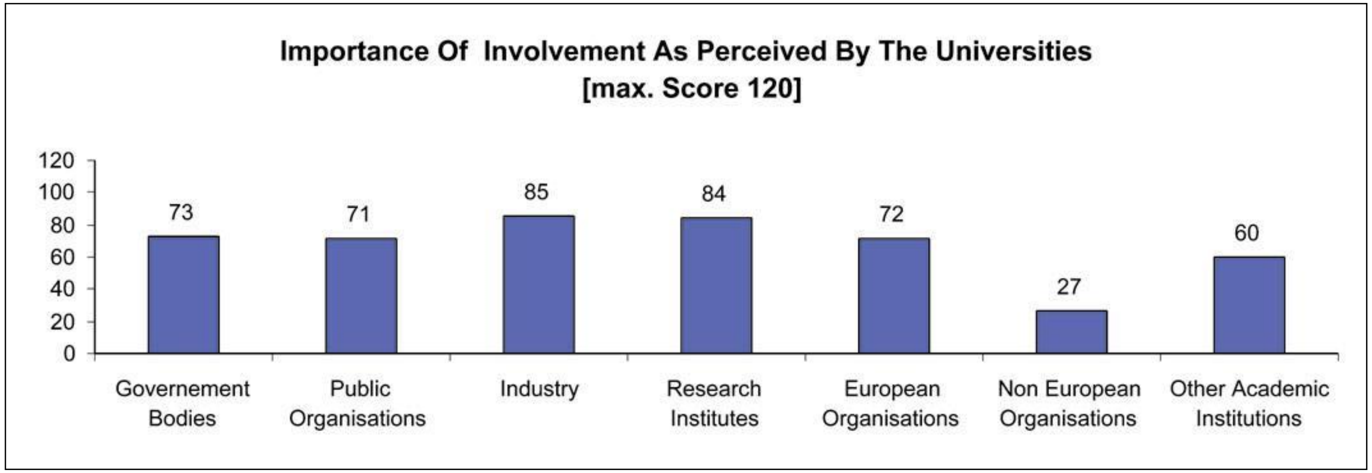

Figure 15

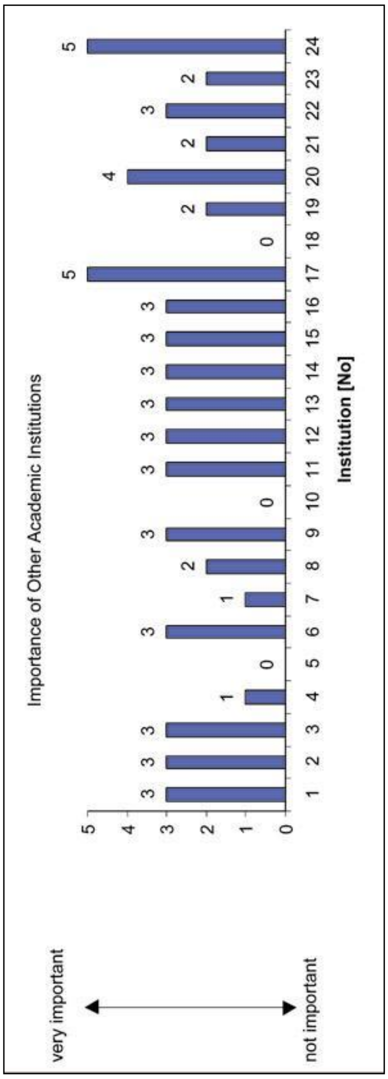

Figure 16

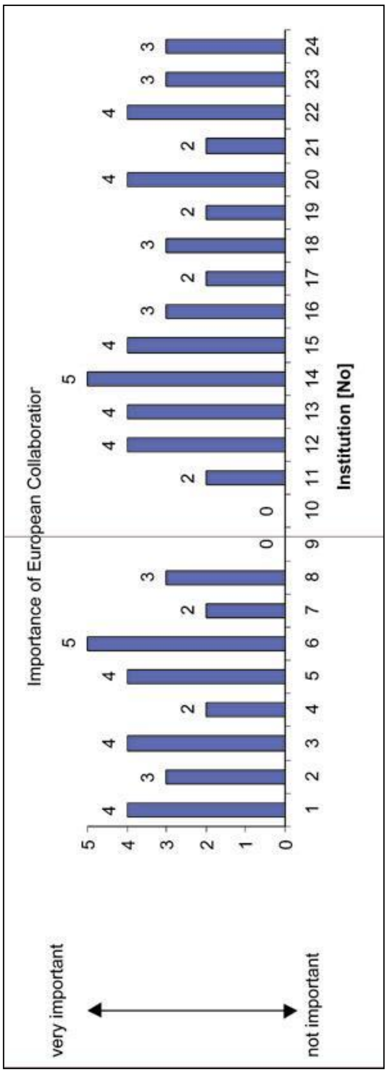

Figure 17

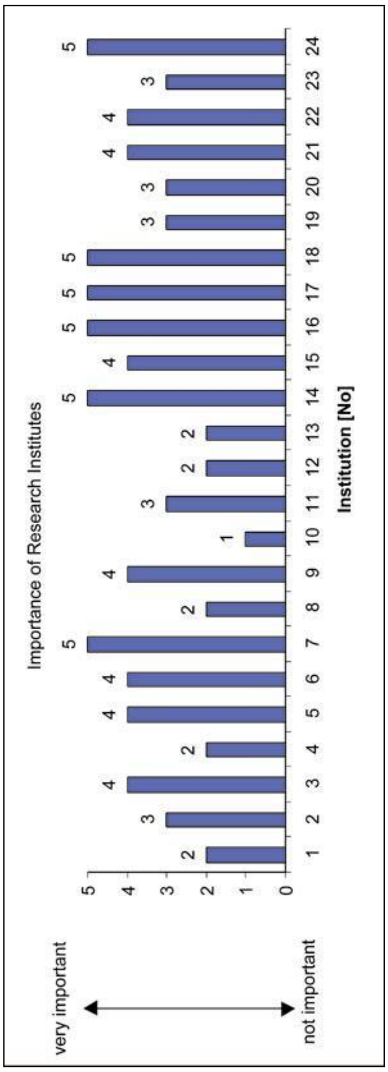

Figure 18

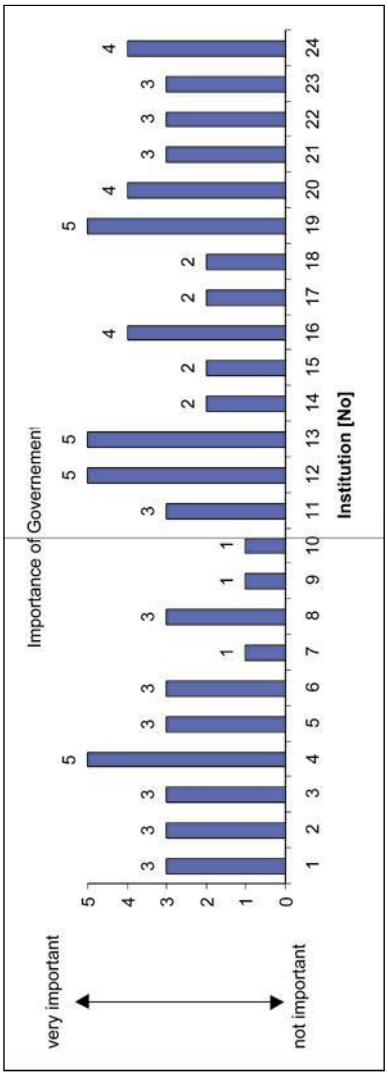

Figure 19

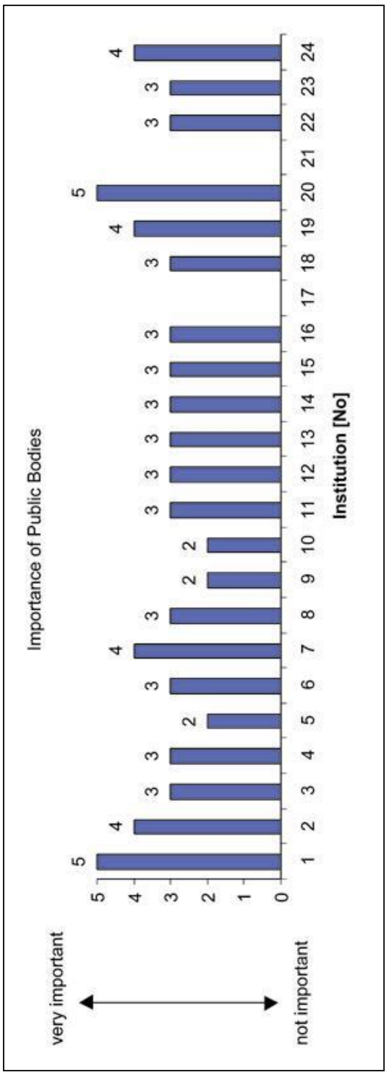
Importance of Public Bodies
very important
not important
Institution [No]

Figure 20

Contacts hours of external staff/ academic year (0.4.)

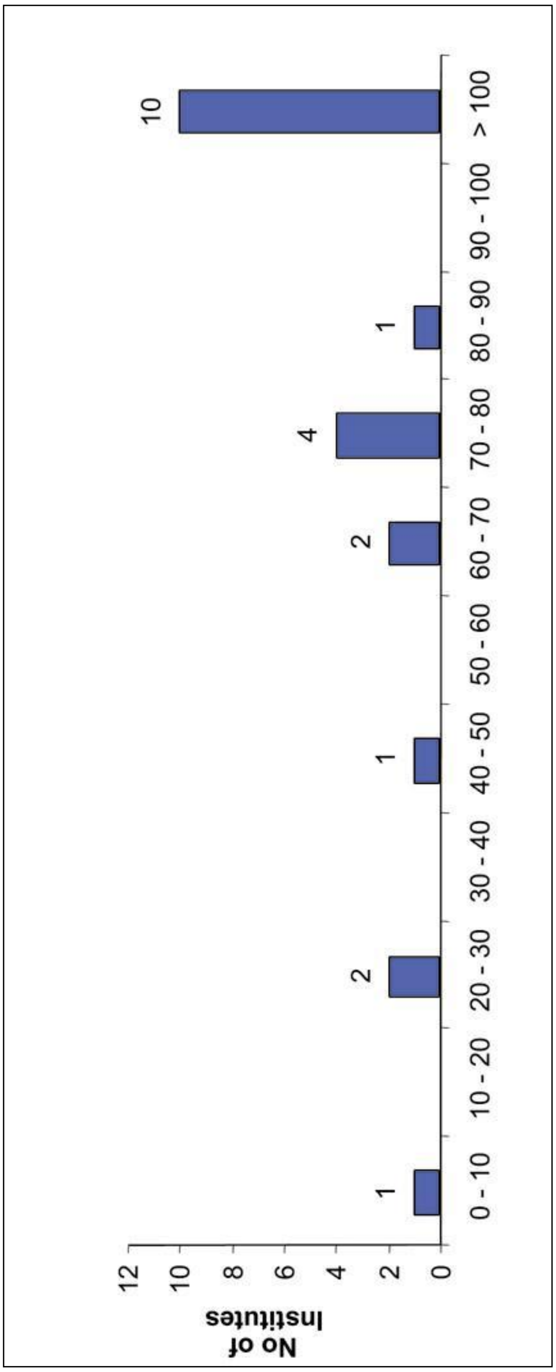

Figure 21

Importance of different links for your institution (0.6.2.)

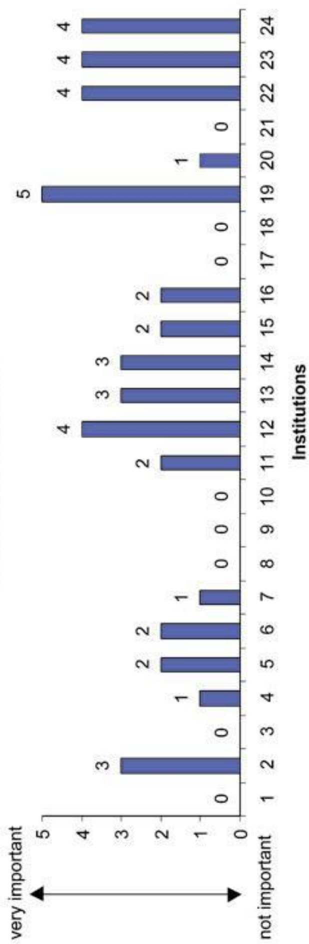

Figure 22

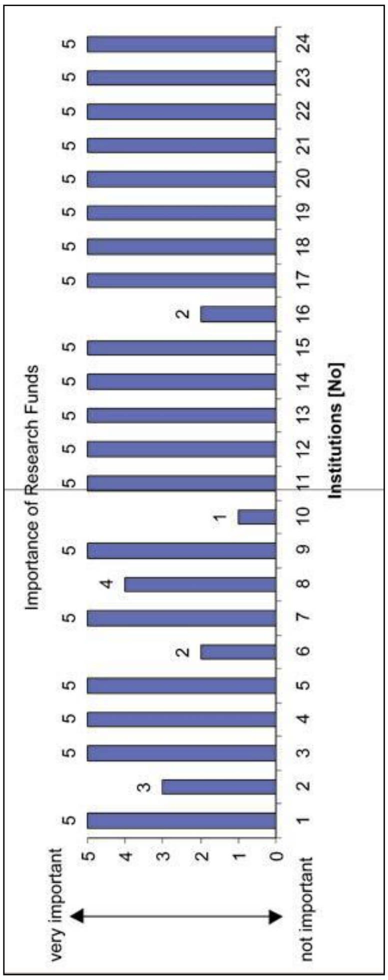

Figure 23

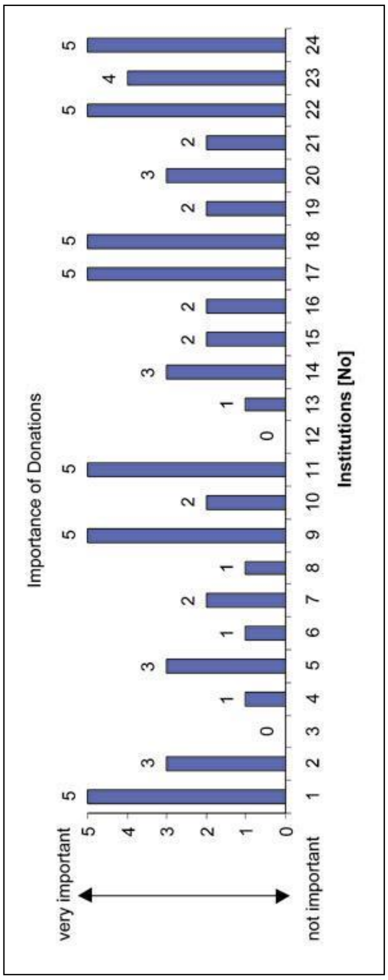

Figure 24

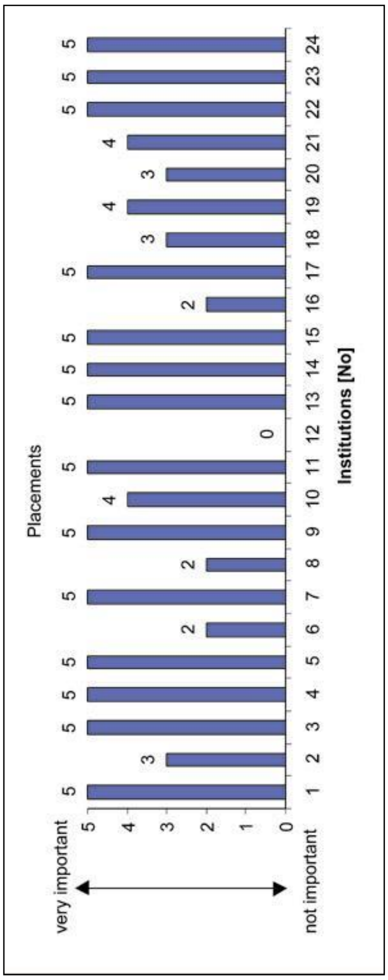

Figure 25

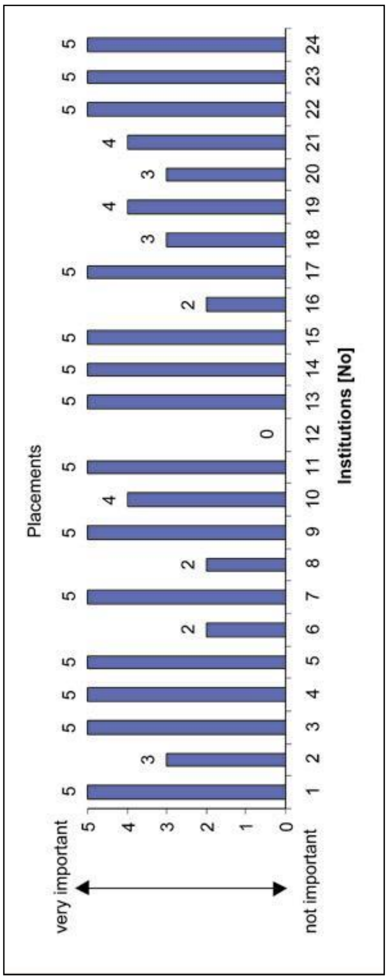

Figure 26

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ERRATUM

- *Page 17*

Table 4, lines 4 and 5 should be read:

"14 April 2000, Barcelona - 3rd meeting of Working Group C
14 - 15 April 2000, Porto - 3rd meeting of Working Group B"

- *Page 23*

The first part of the section 8.5 was printed twice and should be deleted.

- *Page 49*

The third paragraph of section 3.2 should be read:

'… the "anglo-saxon" (or two-tier) system, with undergraduate courses leading to a Bachelor of Engineering degree after 3 years (in England) and 4 years (in Scotland and the Irish Republic), followed by …'

- *Pages 185 – 194*

Page 185	**TOTAL G**		136	208	222	222	171	48	120	120
Page 186	**TOTAL G**		450	0	502	0	1000	320	800	0
Page 187	**TOTAL G**		300	0	0	0	0	0	0	0
Page 188	**TOTAL G**		0	0	0	1100	0	0	0	50
Page 189	**TOTAL G**		320	115	0	0	0	100	0	
Page 190	**TOTAL G**		560	640	403	403	154	0	0	
Page 191	**TOTAL G**		0	360	165	210	210	0	15	
Page 192	**TOTAL G**		200	20	210	408	270	15	0	0
Page 193	**TOTAL G**		197	146	166	70	144	0	155	
Page 194	**TOTAL G**		120	0	0	138	56	60	45	

- *Page 217*

The section should be number 5, not 4

- *Pages 294 – 295*

The last sections numbers are 11, 12 and 13 instead of 12, 13 and 14.