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SOCRATES - ERASMUS
THEMATIC NETWORK PROJECT

EUROPEAN CIVIL ENGINEERING EDUCATION AND TRAINING

EUCEET

SIXTH EUCEET VOLUME

Edited by
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FOREWORD

This is the sixth of a series of volumes to be published within 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 comprises the Reports pertaining to four, out of the total of six, themes undertaken under EUCEET II:

- Theme B "*Development of the teaching environment in civil engineering education*" (coordinator: professor Eivind Bratteland, Norwegian University of Science and Technology Trondheim)
- Theme C "*Promoting the European dimension in civil engineering education*" (coordinator: professor Richard Kastner, Institut National des Sciences Appliquées – INSA Lyon)
- Theme D *"Enhancing the attractiveness of civil engineering profession"* (coordinator: François – Gérard Baron, Conseil National des Ingénieurs et Scientifiques de France)
- Theme F *"Lifelong learning in civil engineering"* (coordinator: professor Pericles Latinopoulos, Aristotle University of Thessaloniki)

There are six reports prepared by the Working Groups in charge with six Specific Projects (two under theme B, two under theme C and one under each of themes D and E).

The volume opens with an overview of the EUCEET II project, prepared by professor Marie-Ange Cammarota, Ecole Nationale des Ponts et Chaussées, Coordinator of the EUCEET II Project and professor Iacint Manoliu, Technical University of Civil Engineering Bucharest.

Due to space limitations, annexes to various reports could not be printed. However, the CD attached to the volume contains the reports in full extent, including annexes.

The editor expresses his gratitude to the authors of the Reports and to all active partners of EUCEET Consortium for their contribution and support.

Professor Iacint MANOLIU

Chairman of EUCEET II Management
Committee

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(1 October 2002 – 31 December 2005) - an overview

EUCEET II (1 October 2002 - 31 December 2005) - AN OVERVIEW

Marie-Ange Cammarota[1], Iacint Manoliu[2]

On 24th July 2002, Ecole Nationale des Ponts et Chaussées, as Applicant, was notified by the European Commission that the application for a new Project EUCEET II was approved for a 3-year duration, starting on 1st October 2002. Eventually, the Financial Agreement number 104437-CP-1-2002-1-FR-Erasmus TN was concluded between Ecole Nationale des Ponts et Chaussées, as Contractor, and the European Commission. A 3-month extension of the project was granted in September 2005 and thus EUCEET II ended on 31st December 2005.

This paper is aimed to overview activities undertaken under EUCEET II for the whole duration - 39 months - of the project. Information will be essentially limited to the meetings of the Management Committee and to the General Assemblies, since reference to the meetings of the Working Groups are being made in the reports presented by the WGs and included in the volumes 5 and 6 of EUCEET.

In the Annex of the paper is shown the attendance of the three EUCEET II General Assemblies: Athens (20-21 February 2003, Malta (6-7 May 2004) and Paris (29-30 September 2005).

1. EUCEET II in the first year (2002-2003)

In the table 1 is given a chronology of the meetings which took place in the first year of EUCEET II (1 October 2002 - 30 September 2003).

Table 1

EUCEET II meetings in the 1st year	
Date, venue	**Purpose**
6 December 2002, Paris	1st meeting of the EUCEET II Management Committee
20-21 February 2003, Athens	1st EUCEET II General Assembly
21 February 2003, Athens	1st (joint) meeting of the Working Groups for the Specific Projects 1 and 2
21 February 2003, Athens	1st meeting of the Working Group for the Specific Project 5
21 February 2003, Athens	1st meeting of the Working Group for the Specific Project 7
21 February 2003, Athens	1st meeting of the Working Group for the Specific Project 9
21 February 2003, Athens	1st meeting of the Working Group for the Specific Project 10
21 February 2003, Athens	2nd meeting of the EUCEET II Management Committee
13 June 2003, Louvain-la-Neuve	2nd (joint) meeting of the Working Groups for the Specific Projects 1 and 2
18 July 2003, Torino	2nd meeting of the Working Group for the Specific Project 9
17 September 2003, Ciudad Real	3rd meeting of the EUCEET II Management Committee
18-20 September 2003, Ciudad Real	International Meeting on Civil Engineering Education (Encontro Internacional de la Ensenanza de la Ingenieria Civil)

[1] Professor, Ecole Nationale des Ponts et Chaussées, Paris, France
[2] Professor , Technical University of Civil Engineering, Bucharest, Romania

- *The 1st meeting of the EUCEET II Management Committee, Paris, 6 December 2002*

The meeting was organized and hosted by the Ecole Nationale des Ponts et Chaussées and was attended by the following members: Prof. Marie-Ange Cammarota, ENPC Paris, EUCEET II Coordinator; Prof. Iacint Manoliu, Technical University of Civil Engineering Bucharest, Management Committee Chairman; Prof. David Lloyd Smith and Colin Kerr, Imperial College London; Prof. Laurie Boswell, City University London; Prof. José Luis Juan-Aracil, Technical University of Madrid; Prof. Josef Machacek, Czech Technical University Prague and AECEF; Prof. Xavier Sanchez Vila, Technical University of Catalunya, Barcelona; Prof. Peter Ruge, Technical University Dresden; Prof. Ryszard Kowalczyk, University of Beira Interior, Covilha; Prof. Stanislaw Majewski, Silesian University of Technology, Gliwice; Prof. Pericles Latinopoulos, Aristotle University of Thessaloniki; Prof. Antal Lovas, Budapest University of Technology and Economics; Prof. Nicoleta Radulescu, Technical University of Civil Engineering Bucharest; François-Gerard Baron, Conseil National des Ingenieurs et Scientifiques de France.

The meeting was attended also by the representative of the National Technical University of Athens, Prof. Maria Pantazidou and by the representative of ENPC Paris, Thomas Harcharick.

The main results of the meeting, as put into evidence by the minutes, were:

- presentation of the provisions of the contract for the 1st year of EUCEET
- establishing EUCEET II general framework
- defining the involvement of various categories of partners (higher education institutions, research centers, professional associations, companies) in the activities related to various Specific Projects
- deciding on the coordination of the Themes
- deciding on the chairpersons of working groups for the 12 Specific Projects
- preliminary discussions on the terms of references for the 6 Specific Projects to start in the 1st year
- tentative programme of the 1st General Assembly to be held in Athens on 20-21 February 2003
- logistic matters related to the General Assembly in Athens.

- *1st EUCEET II General Assembly, Athens, 20-21 February 2003*

The 1st EUCEET II General Assembly organized and hosted by the National Technical University of Athens in the modern Zografou campus represented a real success. The meeting was highlighted by the introductory lecture delivered by Prof. T. Xantopoulos, Rector of NTUA, on "*Market Globalisation, European University Education and the Bologna Declaration*".

The General Assembly was attended by representatives of the following institutions partners in EUCEET II: Technical University Graz, Université de Liège, Université Catholique de Louvain, University of Architecture, Civil Engineering and Geodesy Sofia, Cyprus Council of Civil Engineers, University of Pardubice, Czech Technical University Prague, Technical University Ostrava, Association of European

Participants at 1st EUCEET II General Assembly,
Athens, Greece, 20 – 21 February 2003

Civil Engineering Faculties, Fachhochschule Oldenburg, Technical University Dresden, Technical University Berlin, Technical University Darmstadt, Engineering College Odense, Aalborg University, Technical University Tallin, Universidad Politecnica Madrid, Universidad Politecnica Coruna, Universidad Politecnica de Catalunya Barcelona, CEDEX Madrid, Conseil National des Ingénieurs et Scientifiques de France, Institut National des Sciences Appliquées Lyon, Institut National des Sciences Appliquées Toulouse, Ecole Normale Supérieur Cachan, Ecole Nationale des Ponts et Chaussées Paris, Institut Supérieur de Beton Armé Marseille, Aristotle University of Thessaloniki, University of Patras, Technological Educational Institute Thessaloniki, University of Pecs, Budapest University of Technology and Economies, University of Dublin, Institution of Engineers Ireland, Universita Tor Vergata Rome, Politecnico di Torino, Politecnico di Milano, Universita Trento, Vilnius Gediminas Technical University, Technical University Riga, University of Malta, Norwegian University of Science and Technology Trondheim, Technical University Bialystok, Technical University Rzeszow, Technical University Lodz, Technical University Wroclaw, Silesian University of Technology Gliwice, University of Coimbra, University of Beira Interior Covilha, Laboratoria Nacional de Engenharia Civil Lisbon, Procema Bucharest, INCERC Bucharest, Technical University Iasi, Technical University Cluj-Napoca, Technical University of Civil Engineering Bucharest.

In the first plenary session of the General Assembly, following the opening session, Prof. Marie-Ange Cammarota and Prof. Iacint Manoliu made a presentation of the project.

The TNP EUCEET II develops, like TNP EUCEET I, around 6 *themes* recognised by the partners to be of major significance for European civil engineering education, shown in the following table:

Theme and Coordinator
A. Curricula issues and developments in civil engineering (I. Manoliu, *Technical University of Civil Engineering Bucharest*)
B. Development of the teaching environment in civil engineering education (E. Bratteland, *Norwegian University of Science and Technology Trondheim*)
C. Promoting the European dimension in civil engineering education (R. Kastner, *Institut National des Sciences Appliquées - INSA Lyon*)
D. Enhancing the attractiveness of civil engineering profession (F.G. Baron, *Conseil National des Ingenieurs et Scientifiques de France*)
E. Recognition of academic and professional civil engineering qualifications (L. Boswell, *City University London*)
F. Lifelong learning in civil engineering (P. Latinopoulos, *Aristotle University Thessaloniki*)

Within each theme, 1 to 4 Specific Projects are defined, which differ among them by duration, by character, by objectives and means of execution. In total, there are 12 Specific Projects, distributed among the six themes as it results from the following table:

Specific Project and Chairman of the Working Group
Theme A SP.1 *Studies and recommendations on core curricula for various degree programmes* (S. Majewski, Silesian University of Technology Gliwice) Sp.2 *Practical placements as part of the civil engineering curricula* (A. Lovas, Budapest University of Technology and Economics) SP.3 *Environmental and sustainable developments matters in civil engineering education* (P. Ruge, Technical University Dresden) SP.4 *Non-technical subjects in civil engineering education* (X. Sanchez Vila, Universitat Politecnica de Catalunya, Barcelona)
Theme B SP.5 *Problem – oriented, projects – based education in civil engineering* (E. Bratteland, Norwegian University of Science and Technology Trondheim) SP.6 *Use of ICT in civil engineering education* (R. Reinecke, Ingenieur – büro Reinecke, Munich)
Theme C SP.7 *Harmonisation of European construction codes and regulations* (J. Machacek, Czech Technical University Prague) SP.8 *Synergies between TN EUCEET and other activities under the Socrates Erasmus programme* (R. Kastner, INSA Lyon)
Theme D SP.9 *Enhancing the attractiveness of civil engineering profession* (F.G. Baron, Conseil National des Ingenieurs et Scientifiques de France
Theme E SP.10 *Specialised knowledge and abilities of graduates of civil engineering programmes* (L. Boswell, City University London) SP.11 *Academic and professional recognition and mobility of European civil engineers* (C. Ahrens, University of Applied Sciences Oldenburg and European Council of Civil Engineers)
Theme F SP.12 *Lifelong learning in civil engineering* (P. Latinopoulos, Aristotle University Thessaloniki)

According to the decision adopted by the Management Committee in its first meeting in Paris, on 6th December 2002, six of the Specific Projects were to be launched at the General Assembly in Athens: SP. 1, SP. 2, SP. 5, SP.7, SP. 9 and SP. 10.

As a consequence, following the first plenary sessions, the General Assembly featured parallel meetings of the working groups for the Specific Projects 1 and 2 (joint meeting) and for the Specific Projects 5, 7, 9 and 10.

In the second day of the General Assembly, the chairpersons of the working groups for the six Specific Projects presented the outcomes of the first meeting of the WG for the respective Specific Project, terms of reference, deliverables expected, plan of activity.

Closing the General Assembly, Prof. Iacint Manoliu wished every success to the newly contributed Working Groups for the six Specific Projects and expressed, on behalf of the Management Committee and of all participants, the warmest thanks to the Rector of the National Technical University of Athens, Prof. T. Xantopoulos, to the Dean of Faculty of Civil Engineering, Prof. A. Agnostopoulos and, in particular, to the contact person of NTUA for EUCEET II, Prof. Marina Pantazidou, for the support provided and for the excellent organisation of the event.

- *The 2nd meeting of the Management Committee, Athens, 21 February 2003*

The meeting took place after the closure of the 1st EUCEET II General Assembly and was attended by the following members: Prof. Marie-Ange Cammarota, ENPC Paris, EUCEET II Coordinator; Prof. Iacint Manoliu, Technical University of Civil Engineering Bucharest, Management Committee Chairman; Prof. David Lloyd Smith and Colin Kerr, Imperial College London; Prof. Laurie Boswell, City University London; Prof. José Luis Juan-Aracil, Technical University of Madrid; Prof. Josef Machacek, Czech Technical University Prague and AECEF; Prof. Xavier Sanchez Vila, Technical University of Catalunya, Barcelona; Prof. Peter Ruge, Technical University Dresden; Prof. Ryszard Kowalczyk, University of Beira Interior, Covilha; Prof. Stanislaw Majewski, Silesian University of Technology, Gliwice; Prof. Pericles Latinopoulos, Aristotle University of Thessaloniki; Prof. Antal Lovas, Budapest University of Technology and Economics, Budapest; Prof. Nicoleta Radulescu, Technical University of Civil Engineering Bucharest.

The main results of the meeting, as put into evidence by the minutes, were:

- Conclusions from the General Assembly
- Decisions concerning the involvement of EUCEET in the International Meeting in Civil Engineering Education to be organized by the Universidad de Castilla-La-Mancha, ETSICCP, Ciudad Real on 18-20 September 2003
- Budgetary problems, in view of the expenditures made so far
- Participations of MC members to future activities under EUCEET II.

- *The 3rd meeting of the Management Committee, Ciudad Real, 17 September 2003*

The meeting was hosted by the Escuela Tecnica Superior de Ingenieros de Caminos, Canales y Puertos - ETSICCP of the University of Castilla -La Mancha, in the eve the International Meeting in Civil Engineering Education, and was attended by the following members of the Management Committee: Prof. Marie-Ange Cammarota, ENPC Paris, EUCEET II Coordinator; Prof. Iacint Manoliu, Technical University of Civil Engineering Bucharest, Management Committee Chairman; Prof. David Lloyd Smith and Colin Kerr, Imperial College London; Prof. Laurie Boswell, City University London; Prof. Jose Luis Juan-Aracil, Technical University of Madrid; Prof. Josef Machacek, Czech Technical University Prague and AECEF; Prof. Xavier Sanchez Vila, Technical University of Catalunya, Barcelona; Prof. Peter Ruge, Technical University Dresden; Prof. Ryszard Kowalczyk, University of Beira Interior, Covilha; Prof. Stanislaw Majewski, Silesian University of Technology, Gliwice; Prof. Pericles Latinopoulos, Aristotle University of Thessaloniki; Prof. Antal Lovas, Budapest University of Technology and Economics; Prof. Nicoleta Radulescu, Technical University of Civil Engineering Bucharest; Manfred Federau, Engineering College Odense.

The main points on the agenda, as put into evidence by the minutes, were:

- presentation of the financial situation of the Project, by Prof. Marie-Ange Cammarota, Coordinator
- brief reports made by the chairpersons of the Working Groups for the Specific Projects launched at the GA in Athens

- presentation of the activity plan for the 2nd year of the Project (10 October 2003-30 September 2004) made by Prof. Iacint Manoliu, Chairman of the Management Committee
- preliminary discussions on the preparation of a EUCEET statement on the Bologna process.

- *The International Meeting in Civil Engineering Education, Ciudad Real, 18-20 September 2003*

Organised by the University Castilla - La Mancha, as one of the events celebrating the Second Centenary of Civil Engineering Studies in Spain and the graduation of the First Class of Civil Engineers trained by Castilla - La Mancha University, the International Meeting in Civil Engineering Education gathered 250 participants from 25 countries and 3 continents, representing the main stakeholders in civil engineering education: academia, industry, professional associations.

A large number of EUCEET II partners sent their representatives to the meeting in Ciudad Real, namely: Université de Liège, Technical University Ostrava, Technical University Dresden, Fachhochschule Oldenburg, Aalborg University, Technical University Tallin, Universidad Politecnica de Catalunya Barcelona, Universidad Politecnica Madrid, Universidad de Cantabria Santander, Universidad de Castilla - La Mancha Ciudad Real, Universidad Politecnica Valencia, CEDEX Madrid, Institut National des Sciences Appliquées Toulouse, Institut National des Sciences Appliquées Lyon, Ecole Normale Supérieur Cachan, Ecole Normale des Ponts et Chaussées Paris, Technological Educational Institute Piraeus, Aristotle University Thessaloniki, National Technical University Athens, Budapest University of Technology and Economics, Delft University of Technology, Norwegian University of Science and Technology Trondheim, Technical University Bialystok, Technical University Wroclaw, Silesian University of Technology Gliwice, University of Coimbra, University of Beira Interior Covilha, Laboratorio National de Engenharia Civil Lisbon, Instituto Superior Tecnico Lisbon, University of Minho, Technical University of Civil Engineering Bucharest, University Ovidius Constantza, Technical University Cluj-Napoca, City University London, Imperial College London, Trinity College Dublin, University of Maribor, Royal Institute of Technology Stockholm.

Prof. Iacint Manoliu, Chairman of EUCEET II Management Committee, delivered the opening lecture of the International Meeting. 16 other lectures were presented by EUCEET II representatives, who were also very active in the parallel sessions of the 6 main sessions of the Meeting.

Having in view the solid representation and the significant contribution brought by EUCEET II partners, the “Encontro Internacional de Ensenanza de la Ingenieria Civil” can be considered as a true EUCEET II General Assembly, placed at the end of the first year of the Project.

Other meetings at which presentations on EUCEET II were made

Dissemination of EUCEET outcomes and objectives was made by comprehensive presentations at various meetings and Conferences, such as:

- XIII[th] European Conference on Soil Mechanics and Geotechnical Engineering, Main Session 6 "European Geotechnical Networking", Prague, 25-28 August 2003
- The 37th ECCE meeting, Madrid, 4-5 April 2003
- SEFI meeting, Prague, 26 April 2003
- The 38th ECCE meeting, Munich, 19-20 September 2003

2. EUCEET II in the second year (2003-2004)

In the table 2 is given a chronology of the meetings which took place in the second year of EUCEET II (1 October 2003 – 30 September 2004).

Table 2.

EUCEET II meetings in the 2nd year	
Date, venue	**Purpose**
6-8 November 2003, Malta	Meeting of the EUCEET II Board
13-14 February 2004, Brussels	Techno TN 2004 Forum
16 February 2004, Paris	4th meeting of the EUCEET II Management Committee
5-6 March 2004, Odense	3rd meeting of the Working Group for the Specific Project 5
6-7 May 2004, Malta	Second EUCEET II General Assembly
6 May 2004, Malta	3rd meeting of the Working Group for the Specific Project 1
6 May 2004, Malta	3rd meeting of the Working Group for the Specific Project 5
6 May 2004, Malta	3rd meeting of the Working Group for the Specific Project 9
6 May 2004, Malta	2nd meeting of the Working Group for the Specific Project 10
7 May 2004, Malta	1st meeting of the Working Group for the Specific Project 3
7 May 2004, Malta	1st meeting of the Working Group for the Specific Project 4
7 May 2004, Malta	1st meeting of the Working Group for the Specific Project 6
7 May 2004, Malta	1st meeting of the Working Group for the Specific Project 8
7 May 2004, Malta	1st meeting of the Working Group for the Specific Project 11
7 May 2004, Malta	1st meeting of the Working Group for the Specific Project 12
7 May 2004, Malta	1st meeting of the EUCEET – Tuning Task Force
23 September 2004, Paris	Meeting of the core members of the Working Group for the Specific Project 9
24 September 2004, Paris	2nd meeting of the EUCEET – Tuning Task Force

- *Meeting of the EUCEET II Board, 6-8 November 2004, Malta*

The meeting was attended by four members of the EUCEET II Management Committee: Prof. Marie-Ange Cammarota, ENPC Paris, Coordinator, Prof. Iacint Manoliu, TUCEB Bucharest, MC Chairman, Prof. José Luis Juan Aracil, Universidad Politecnica de Madrid, Colin Kerr, Imperial College London.

EUCEET II representatives met with competent authorities of the University of Malta. Different logistic options for the General Assembly to be organized and hosted by the University of Malta in the spring of 2005 were analyzed and a decision concerning the date and venue of the GA was adopted.

- *Techno TN 2004 Forum, Brussels, 13-14 February 2004*

At the initiative of the Directorate General for Education and Culture of the European Commission, representatives of the science and engineering oriented Socrates Thematic Networks were invited to attend an expert Forum in Brussels, named Techno TN 2004. EUCEET II was represented by Prof. Iacint Manoliu, TUCE Bucharest, Prof. Xavier Sanchez-Vila, Universidad Politecnica de Catalunya Barcelona, Prof. Laurie Boswell, City University London, Colin Kerr, Imperial College London, Prof. Manfred Federau, Engineering College Odense, Prof. Eivind Bratteland, Trondheim University of Science and Technology, Prof. Pericles Latinopoulos, Aristotle University Thessaloniki, Dr. Ralf Reinecke, IB Reinecke Munich.

Prof. Iacint Manoliu chaired the Workshop “Impact of the Bologna Process”. Other members of the EUCEET II delegation actively participated in the 5 working groups of the Forum.

Techno TN 2004 Forum gave an excellent opportunity for an exchange of views and experience with representatives of other TNs in science and engineering.

- *4th meeting of the EUCEET II Management Committee, Paris, 16 February 2004*

The meeting was organised and hosted by the Ecole Nationale des Ponts et Chaussées and attended by the following members of the Management Committee: Prof. Marie-Ange Cammarota, ENPC Paris, EUCEET II Coordinator; Prof. Iacint Manoliu, Technical University of Civil Engineering Bucharest, Management Committee Chairman; Dr. David Lloyd Smith and Colin Kerr, Imperial College London; Prof. Laurie Boswell, City University London; Prof. José Luis Juan-Aracil, Technical University Madrid; Prof. Josef Machacek, Czech Technical University Prague and AECEF; Prof. Xavier Sanchez Vila, Technical University of Catalunya, Barcelona; Prof. Peter Ruge, Technical University Dresden; Prof. Riszard Kowalczyk, University of Beira Interior, Covilha; Prof. Stanislaw Majewski, Silesian University of Technology, Gliwice; Prof. Pericles Latinopoulos, Aristotle University of Thessaloniki; Prof. Antal Lovas, Budapest University of Technology and Economics, Budapest; Prof. Nicoleta Radulescu, Technical University of Civil Engineering Bucharest; Manfred Federau, Engineering College Odense.

The main points on the agenda, as revealed by the minutes, were:

- Reports presented by the chairpersons of the Working Groups for the Specific Projects launched in February 2003 in Athens: Prof. S. Majewski, SUT Gliwice,

for SP.1, Prof. A. Lovas, Budapest UTE, for SP.2, Prof. M. Federau, IOT Odense, for SP.5, Prof. J. Machacek, CTU Prague, for SP.7, Colin Kerr, Imperial College, for SP.9, L. Boswell, City University, for SP.10.
- Terms of reference for the Specific Projects to be launched at the GA in Malta (SP.3, SP.4, SP.6, SP.8, SP.11, SP.12) presented by the Chairpersons of the Working Groups for the respective Specific Projects.
- Decisions on the final programme of the Second EUCEET II General Assembly to be held in Malta, on 6-7 May 2004.

A very important outcome of the meeting was the adoption of a position statement of EUCEET II Management Committee on the Bologna Declaration. A draft of the statement, prepared by Prof. Iacint Manoliu, was circulated among EUCEET II Management Committee members after the meeting in Ciudad Real on 17 September 2003. In the meantime proposals and amendments were received by the Chairman. After vivid discussions, a final form of the statement was reached and adopted with a clear majority by the members of the Management Committee.

The position statement of EUCEET II Management Committee on the implementation of the Bologna Declaration in civil engineering education is reproduced in what follows.

"EUCEET is supporting and encouraging the application of the idea of two-tier education system in Civil Engineering as suggested in Bologna Declaration.

The adoption of a system based on two main cycles, whenever takes place, must take into consideration the specificity of the civil engineering education and profession. Civil engineers perform and provide services to the community with significant implications for public safety and health. As a consequence, the first cycle in civil engineering education shall be relevant to the labor market and shall ensure graduates with a level of competences tuned to the substantial responsibilities of the profession. A duration of 4 years (or the equivalent of 240 ECTS credits) seems to fit that purpose.

A 4-year duration of the first cycle in civil engineering education is aimed also at facilitating transnational recognition of degrees and professional mobility of European civil engineers. In this respect, due consideration has to be given to the fact that various alliances between engineering organizations, such as Washington Accord and the Engineers Mobility Forum, have established that the required academic component of the qualification of a professional engineer should be 4 or 5 years full time study in University.

The existing integrated 5-year curricula in civil engineering, leading straight to a Master's degree, is also compatible with the letter and spirit of the Bologna Declaration and with the vision of a European Higher Education Area."

- *Second EUCEET II General Assembly, Malta, 6-7 May 2004*

The Second EUCEET II General Assembly was organised by the University of Malta, Faculty of Architecture and Civil Engineering. The following EUCEET II partners were represented at the General Assembly: Université de Liège, Katholieke Universiteit Leuven, Université Catholique Louvain-la-Neuve, Engineering College Odense, University Aalborg, Technical University Dresden, Fachhochschule Oldenburg, IB Reinecke Munich, National Technical University Athens, Aristotle University Thessaloniki, Technological Educational Institute Pireus, Universidad Politecnica Madrid, Universidad Politecnica de Catalunya Barcelona, Universidad

Participants at the 2nd EUCEET II General Assembly,
Malta, 6 – 7 May 2004

Castilla-La Mancha Ciudad Real, Universidad Cantabria Santander, Universidad La Coruna, Ecole Nationale des Ponts et Chaussées Paris, Institut National des Sciences Appliquées Lyon, Institut Supérieur de Beton Armé Marseille, Conseil National des Ingenieurs et Scientifiques de France, Ecole Normale Supérieur Cachan, University of Dublin, Politecnico di Torino, University Tor Vergata Roma, Politecnico di Milano, Delft University of Technology, University of Coimbra, University of Minho, Instituto Superior Tecnico Lisbon, University of Beira Interior Covilha, Helsinki University of Technology, City University London, Loughborough University, Heriot Watt University Edinburgh, Imperial College London, Norwegian University of Science and Technology Trondheim, Biggenaeringens Landsforening Oslo, University of Architecture, Civil Engineering and Geodesy Sofia, Technical University Ostrava, University Pardubice, Czech Technical University Prague, Association of European Civil Engineering Faculties, Technical University Tallin, Cyprus Council of Civil Engineers, Technical University Riga, Vilnius Gediminas Technical University, Budapest University of Technology and Economies University of Pecs, University of Malta, Technical University Szczecin, Technical University Lodz, Technical University Warsaw, Technical University Wroclaw, Roads and Bridges Research Institute Warsaw, Silesian University of Technology Gliwice, Technical University Gdansk, Technical University Bialystok, Technical University Rzeszow, Technical University of Civil Engineering Bucharest, University Politehnca Timisoara, Technical University Iasi, Technical University Cluj-Napoca, University of Constantza, University of Maribor, University of Ljubljana, Technical University Kosice, Slovak Chamber of Civil Engineers, Slovak University of Technology Bratislava, University of Zilina.

The venue of the General Assembly was the New Dolmen hotel in Qawra, Saint Paul’s, Malta.

In the opening session, welcome addresses were made by the Hon. Minister Dr. Louis Galea LLD, the Minister of Education, and by Prof. Roger Ellul Micaleff MD, the Rector of the University of Malta.

In the first plenary session, Prof. Marie-Ange Cammarota, ENPC Paris, EUCEET II Coordinator and Prof. Iacint Manoliu, TUCE Bucharest, Chairman of EUCEET II MC, made a presentation on the Project in the 1st and 2nd year and of the main features of the application for the 3rd year.

Then, Prof. Iacint Manoliu presented his lecture: “*Trends in civil engineering education in Europe in the context of the Bologna process*”.

The second plenary session hosted three invited lectures:

- Prof. Hendrik Ferdinande (University of Gent), Tuning expert: “*The Tuning Methodology*”
- Prof. J. Witzany, Rector, Czech Technical University Prague: “*European Universities and Institutions of Higher Engineering Education on the Threshold of the 21st Century*”
- Prof. T. Brown, Dean, University of Calgary: “*Civil Engineering Education in Canada*”

The afternoon programme started with parallel sessions for the Specific Projects 1 and 5, followed by parallel sessions for the Specific Projects 9 and 10.

The programme of the first day of the GA ended with another plenary session in which were presented final reports for the Specific Project 2 (by Prof. A. Lovas, Budapest University of Technology and Economics) and for the Specific Project 7 (by Prof. J. Machacek, Czech Technical University Prague) and preliminary reports for the other 4 Specific Projects launched at the GA in Athens: Specific Project 1 (by Prof. V. Majewski, S.U.T. Gliwice), Specific Project 5 (by Prof. M. Federau, Engineering College Odense), Specific Project 9 (by Prof. L. Boswell, City University London).

In the first plenary session of the second day of the GA, chairpersons of six new Specific Projects presented the Terms of Reference for the respective projects:

- Prof. P. Ruge, TU Dresden, for SP.3
- Prof. X. Sanchez-Vila, UPC Barcelona, for SP.4
- Dr. R. Reinecke, IB Reinecke Munich, for SP.6
- Prof. R. Kastner, INSA Lyon, for SP.8
- Prof. C. Ahrens, Fachhochschule Oldenburg, for SP.11
- Prof. P. Latinopoulos, Aristotle University Thessaloniki, for SP.12

Three sets of parallel sessions followed in the programme:

- of the Working Groups for the Specific Projects 3 and 12
- of the Working Groups for the Specific Projects 4 and 6
- of the Working Groups for the Specific Projects 8 and 11

In the afternoon plenary session, there were two invited lectures:

- Juan Elizaga, Director General for Institutional Relations of Ferrovial – Agroman, Spain, presented his invited lecture on the demands of the industry for the graduates of civil engineering schools in Europe.
- Prof. A. Nowak from the University of Michigan spoke about problems faced by the civil engineering education in U.S.A.

The plenary session concluded with the presentations of the work plans for the new Specific Projects by the chairpersons of the newly constituted Working Groups.

In the closing session of the General Assembly, participants were greeted by Prof. Joseph Falzon, Dean of the Faculty of Architecture and Civil Engineering, University of Malta.

Conclusions of the General Assembly were drawn by Prof. Iacint Manoliu, Chairman of the EUCEET II MC, who expressed sincere thanks to the University of Malta and in particular to Prof. Dion Buhagiar to whom the Faculty of Architecture and Civil Engineering confined the task to support EUCEET in the organisation of the second General Assembly.

- *1st meeting of the EUCEET-Tuning Task Force, 7 May 2004, Malta*

The first meeting of the EUCEET-Tuning Task Force took place in Malta, on 7th May 2004, after the closure of the Second EUCEET II General Assembly.

The meeting was attended by the representatives of the following institutions partners in EUCEET II: Silesian University of Technology, Gliwice; National Technical University Athens; Slovak Technical University Bratislava; University of Zilina; Czech Technical University Prague; Technical University Ostrava; University of Malta; Imperial College London; Budapest University of Technology and Economics; Vilnius Gediminas Technical University; Norwegian University of Science and Technology; Delft University of Technology; Trinity College Dublin; Technical University of Civil Engineering Bucharest; Technical University Iasi; Technical University Cluj-Napoca; Ovidius University Constantza; University Politecnica Timisoara; Technical University Dresden; Technical University Darmstadt; University of Liège; Helsinki University of Technology; Aristotle University Thessaloniki; Engineering College Odense; University of Beira Interior Covilha; City University

London; University of Ljubljana; Ecole Nationale des Ponts et Chaussées; University of Architecture, Civil Engineering and Geodesy Sofia.

Opening the meeting, Prof. Iacint Manoliu Chairman of the EUCEET-Tuning Task Force informed about the decision of the Management Committee to give a positive answer to the demand of the Directorate General for Education and Culture to involve the Thematic Network in the lines 1 and 2 of the Tuning Project, atop of the 12 Specific Projects previewed in the application approved when the contract was granted. The proposal of the MC addressed to Tuning Coordinators, to designate Prof. Hendrik Ferdinande from Gent University as Tuning expert for EUCEET II, was accepted, enabling thus Prof. Ferdinande to make a general presentation on Tuning during a plenary session of the General Assembly and to participate at the first meeting of the EUCEET-Tuning Task Force.

Prof. Hendrik Ferdinande gave detailed information on the Tuning methodology, with emphasis on the Line 1 "*Generic Competences*" and on the Line 2 "*Subject Specific Competences*". For both lines, questionnaires have to be prepared. Within Tuning were prepared questionnaires on generic competences: a questionnaire containing 30 competences, to be addressed to the graduates and to employers and a questionnaire containing 17 competences, to be addressed to academics. Conditions for undertaking the survey (number of answers to be obtained by each participating university, type of response requested etc) were described. The questionnaire on Subject Specific Competences, to be addressed only to academics, was prepared by the Tuning working groups of experts in the different areas. Respondents were asked, for each of the competences, to range the level of importance that it had, in their opinion, in both the first and second cycle.

Following the presentation made by Prof. Ferdinande, discussions on the involvement of EUCEET in the Tuning project took place.

In conclusion, Prof. Iacint Manoliu announced that the EUCEET-Tuning Task Force will prepare the Tuning questionnaire for Subject Specific Competences in Civil Engineering by the end of the 2nd year of EUCEET II, in order to run the Tuning surveys in the 3rd EUCEET II year, 2004-2005.

- *2nd meeting of the EUCEET-Tuning Task Force, Paris 24 September 2004*

The second meeting of the EUCEET-Tuning Task Force was organised and hosted by the Ecole Nationale des Ponts et Chaussées, on 24th September 2004.

The meeting was attended by the following members of the EUCEET-Tuning Task Force: Prof. Iacint Manoliu, Technical University of Civil Engineering Bucharest, Chairman of the EUCEET-Tuning Task Force, Prof. Laurie Boswell, City University London, Deputy Chairman of the EUCEET-Tuning Task Force, Prof. Vaclav Kuraz, Czech Technical University Prague, Prof. Eivind Bratteland, Norwegian University of Science and Technology, Prof. José Luis Juan Aracil, Universidad, Politecnica Madrid, Prof. David Lloyd Smith, Colin Kerr, Imperial College London, Prof. Antal Lovas and Prof. Gyorgy Farkas, Budapest University of Technology and Economics, Prof. Stanislaw Majewski, Silesian University of Technology Gliwice, Prof. Manfred Federau, Engineering College Odense, Prof. Pericles Latinopoulos, Aristotle University of Thessaloniki, Prof. Nicoleta Radulescu, Technical University of Engineering Bucharest, Prof. Roger Frank, Ecole Nationale des Ponts et Chaussées, Dr. Ralf Reinecke, IB Reinecke Munich.

The aim of the meeting was to produce the questionnaire on Subject Specific Competences for Civil Engineering, necessary to run the Tuning survey. As a base for discussions served a draft prepared by Prof. Vaclav Kuraz, CTU Prague.

A list of 18 Specific Competences for Civil Engineering resulted by the end of the meeting. It was decided to complement the list with comments following each competence.

The questionnaire on Subject Specific Competences in Civil Engineering in its final form to be obtained in the following weeks by e-mail consultations among the members of the Task Force, was due to be submitted to the approval of EUCEET II Management Committee at the meeting scheduled in Barcelona, on 10th December 2004.

3. EUCEET II in the third year (2004-2005)

In the table 3 is given a chronology of the meetings which took place in the third year of EUCEET II (1 October 2004 - 31 December 2005).

Table 3

EUCEET II meetings in the 3rd year	
Date, venue	**Purpose**
10 December 2004, Barcelona	5th meeting of the EUCEET II Management Committee
18 February 2005, Lyon	2nd meeting of the Working Group for the Specific Project 8
11 March 2005, Budapest	Meeting of the ad-hoc group for the Specific Project 5
15 April 2005, Athens	2nd meeting of the Working Group for the Specific Project 3
22 April 2005, Thessaloniki	2nd meeting of the Working Group for the Specific Project 12
13 May 2005, Budapest	3rd meeting of the Working Group for the Specific Project 8
20 May 2005, Oldenburg	2nd meeting of the Working Group for the Specific Project 11
4 June 2005, Munich	2nd meeting of the Working Group for the Specific Projects 6
14 June 2005, Helsinki	6th meeting of the EUCEET II Management Committee
26 July 2005, Gliwice	Meeting of core members of the Working Group for the Specific Project 1
28 September 2005, Paris	7th meeting of the EUCEET II Management Committee
29-30 September 2005, Paris	3rd EUCEET II General Assembly
29 September 2005, Paris	3rd meeting of the Working Group for the Specific Project 3
29 September 2005, Paris	2nd meeting of the Working Group for the Specific Project 4
29 September 2005, Paris	3rd meeting of the Working Group for the Specific Project 6
29 September 2005, Paris	4th meeting of the Working Group for the Specific Project 8
29 September 2005, Paris	3rd meeting of the Working Group for the Specific Project 11
29 September 2005, Paris	3rd meeting of the Working Group for the Specific Project 12
25 November 2005, Riga	3rd meeting of the EUCEET-Tuning Task Force
10 December 2005, Nicosia	8th meeting of the EUCEET II Management Committee

- *5th meeting of the EUCEET II Management Committee, Barcelona, 10 December 2004*

The meeting was organized and hosted by the Technical University of Catalunya, Barcelona and was attended by the following members of the EUCEET II Management Committee: Prof. Marie-Ange Cammarota, ENPC Paris, EUCEET II Coordinator; Prof. Iacint Manoliu, Technical University of Civil Engineering Bucharest, Management Committee Chairman; Prof. David Lloyd Smith and Colin Kerr, Imperial College London; Prof. Laurie Boswell, City University London; Prof. José Luis Juan-Aracil, Technical University Madrid; Prof. Josef Machacek, Czech Technical University Prague and AECEF; Prof. Xavier Sanchez Vila, Technical University of Catalunya, Barcelona; Prof. Peter Ruge, Technical University Dresden; Prof. Ryszard Kowalczyk, University of Beira Interior, Covilha; Prof. Stanislaw Majewski, Silesian University of Technology, Gliwice; Prof. Pericles Latinopoulos, Aristotle University of Thessaloniki; Prof. Antal Lovas, Budapest University of Technology and Economics, Budapest; Prof. Nicoleta Radulescu, Technical University of Civil Engineering Bucharest; Prof. Manfred Federau, Engineering College Odense; Prof. Richard Kastner, Institut National des Sciences Appliquées Lyon.

Reports were presented by chairpersons of the Working Groups for the Specific Projects launched at the General Assembly in Malta: Prof. Peter Ruge for SP.3, Prof. Xavier Sanchez-Vila for SP.4, Dr. Ralf Reinecke for SP.6, Prof. Richard Kastner for SP.8 and Prof. Pericles Latinopoulos for SP.12.

The content of the report for the Specific Project 5 was discussed and an ad-hoc team charred by Prof. D.L. Smith was formed. Members of the WG for SP 5 were invited to submit new contributions for SP.5 before the meeting of the ad-hoc team in Budapest, on 11 March 2005.

The Chairman of the EUCEET - Tuning Task Force presented a state-of-the-art regarding the participation of the EUCEET in the Tuning project. The following decisions were adopted:

- the Questionnaire on Generic Competences used by Tuning for academics will be also used by EUCEET partners for employers
- no survey on Generic Competences will be conducted among graduates
- the Questionnaire on Subject Specific Competences for Civil Engineering prepared by the EUCEET-Tuning Task Force was used for academics
- the surveys will be conducted on-line, taking advantage of the support provided by Deusto University

- *6th meeting of the EUCEET II Management Committee, Helsinki, 14 June 2005*

The meeting was organized and hosted by the Helsinki University of Technology and was attended by the following member of EUCEET II Management Committee: Prof. Marie-Ange Cammarota, ENPC Paris, EUCEET II Coordinator; Prof. Iacint Manoliu, Technical University of Civil Engineering Bucharest, Management Committee Chairman; Prof. David Lloyd Smith and Colin Kerr, Imperial College London; Prof. Laurie Boswell, City University London; Prof. José Luis Juan-Aracil, Technical University Madrid; Prof. Josef Machacek, Czech Technical University Prague and AECEF; Prof. Xavier Sanchez Vila, Technical University of Catalunya, Barcelona; Prof. Ryszard Kowalczyk, University of Beira Interior, Covilha; Prof. Stanislaw Majewski, Silesian University of Technology, Gliwice; Prof. Pericles Latinopoulos, Aristotle University of Thessaloniki; Prof. Antal Lovas, Budapest University of Technology and Economics, Budapest; Prof. Nicoleta Radulescu, Technical University of Civil Engineering Bucharest; Prof. Manfred Federau, Engineering College Odense; Prof. Richard Kastner, Institut National des Sciences Appliqueés Lyon.

The meeting was attended also by Prof. Aarne Jutila, contact-person for Helsinki University of Technology in the EUCEET II consortium and host of the meeting.

Chairpersons or core members of the Working Groups presented state-of-the art for the Specific Projects launched at the General Assembly in Malta: Prof. Xavier Sanchez-

Vila for SP.4, Dr. Ralf Reinecke for SP.6, Prof. Richard Kastner for SP.8, Prof. Antal Lovas for SP.11, Prof. Pericles Latinopoulos for SP.12.

The programme of the 3rd EUCEET II General Assembly, to be held in Paris on 29-30 September 2005, was established as well as the names of the key-note lecturers and of the participants to the round table, to be invited by the Coordinator.

- *7th meeting of the EUCEET II Management Committee, Paris, 29-30 September 2005*

The meeting was organized and hosted by the Ecole Nationale des Ponts et Chausses and was attended by the following members of the Management Committee: Prof. Marie-Ange Cammarota, ENPC Paris, EUCEET II Coordinator; Prof. Iacint Manoliu, Technical University of Civil Engineering Bucharest, Management Committee Chairman; Prof. David Lloyd Smith and Colin Kerr, Imperial College London; Prof. Laurie Boswell, City University London; Prof. Josef Machacek, Czech Technical University Prague and AECEF; Prof. Xavier Sanchez Vila, Technical University of Catalunya, Barcelona; Prof. Peter Ruge, Technical University Dresden; Prof. Ryszard Kowalczyk, University of Beira Interior, Covilha; Prof. Stanislaw Majewski, Silesian University of Technology, Gliwice; Prof. Pericles Latinopoulos, Aristotle University of Thessaloniki; Prof. Antal Lovas, Budapest University of Technology and Economics, Budapest; Prof. Nicoleta Radulescu, Technical University of Civil Engineering Bucharest; Prof. Manfred Federau, Engineering College Odense; Prof. Richard Kastner, Institut National des Sciences Appliqueés Lyon.

Prof. Marie-Ange Cammarota, EUCEET II Coordinator, informed the Committee on the organization of the 3rd EUCEET II General Assembly to take place in Paris on 29-30 September 2005: participants, key-note lectures, round-table, logistic matters etc.

Prof. Iacint Manoliu made a synthesis of the proposals and ideas received from various partners concerning a new EUCEET III Project, for which a pre-proposal was due to be submitted to the EC by 1st November 2005.

- *Third EUCEET II General Assembly, Paris, 29-30 September 2005*

The third EUCEET II General Assembly was organized and hosted by the Ecole Nationale des Ponts et Chaussées. Venue of the General Assembly was the historical building of ENPC located at 28, Rue des Saint Péres, Paris.

The following EUCEET II partners were represented at the General Assembly in Paris: Université de Liège, Katholieke Universiteit Leuven, Université Catholique Louvain-la-Neuve, Engineering College Odense, Technical University Dresden, Fachhochschule Oldenburg, IB Reinecke Munich, Technical University Berlin, National Technical University Athens, Aristotle University Thessaloniki, Technological Educational Institute Serres, Universidad Politecnica Madrid, Universidad Politecnica de Catalunya Barcelona, Universidad Castilla-La Mancha Ciudad Real, Universidad Cantabria Santander, Universidad de la Coruna, Ecole Nationale des Ponts et Chaussées Paris, Institut National des Sciences Appliquées Lyon, Institut Supérieur de Beton Armé Marseille, Conseil National des Ingenieurs et Scientifiques de France, Ecole Speciale des Travaux Publics, du Batiment et de L'Industrie Paris, University of Dublin, Politecnico di Torino, University of Trento, Universita degli Studi di Firenze,

A group of participants at the 3rd EUCEET II General Assembly, on the stairs leading to the "**Amphi Caquot**" in the historical building of the Ecole Nationale des Ponts et Chaussées, 28 rue de Saints Pères, Paris

University Tor Vergata Roma, Politecnico di Milano, Delft University of Technology, Universidade do Porto, University of Beira Interior Covilha, Helsinki University of Technology, City University London, Loughborough University, Imperial College London, Norwegian University of Science and Technology Trondheim, University of Architecture, Civil Engineering and Geodesy Sofia, Technical University Ostrava, niversity Pardubice, Czech Technical University Prague, Technical University Tallinn, European Council of Civil Engineers, Cyprus Council of Civil Engineers, Technical University Riga, Vilnius Gediminas Technical University, Budapest University of Technology and Economies, University of Pecs, Technical University Warsaw, Technical University Wroclaw, Roads and Bridges Research Institute Warsaw, Silesian University of Technology Gliwice, Technical University Bialystok, Technical University Rzeszow, Technical University of Civil Engineering Bucharest, University Politehnca Timisoara, Technical University Cluj-Napoca, University of Maribor, University of Ljubljana, Slovak University of Technology Bratislava, University of Zilina, Istanbul University, Middle East Technical University.

In the opening session, Philippe Courtier, Director of ENPC introduced to the participants Ecole Nationale des Ponts et Chaussées and greeted them on behalf of the Direction, of the students and of the teaching staff of the School which celebrated in 1997 its 250th anniversary.

In the first plenary session, Prof. Marie-Ange Cammarota, EUCEET II Coordinator and Prof. Iacint Manoliu, TUCE Bucharest, Chairman of EUCEET II Management Committee presented a General report on EUCEET II.

The first key-note lecture in the programme was then delivered by Prof. Giuliano Augusti, University La Sapienza Rome, who spoke about "*Civil Engineering education and the Bologna first – second cycle scheme*".

The General Assembly continued with three parallel sessions:

- of the Working Group for the Specific Projects 3 and 6
- of the Working Group for the Specific Projects 4 and 11
- of the Working Group for the Specific Projects 8 and 12

In the two plenary sessions programmed before noon in the second day of the General Assembly, final reports for the six Specific Projects were presented by the chairpersons of the Working Groups in charge with the respective Specific Projects:

- Prof. P. Ruge, TU Dresden, for SP.3
- Prof. X. Sanchez-Vila, UPC Barcelona, for SP.4
- Prof. R. Kastner, INSA Lyon, for SP.8
- Prof. R. Reinecke, IB-Reinecke Munich, for SP.6
- Prof. C. Ahrens, UAS Oldenburg, for SP.11
- Prof. P. Latinopoulos, Aristotle University Thessaloniki, for SP.12

In the next plenary session, Prof. Guenter Heitmann, Technical University, Berlin, delivered the key-note lecture: "*Outcomes orientations in quality assurance and curriculum development*".

Prof. Iacint Manoliu, Chairman of the EUCEET-Tuning Task Force, presented a "*Preliminary report of the EUCEET-Tuning Task Force*".

The last plenary session of the General Assembly was devoted to the round table with the theme: "*Civil Engineering in Europe 2020 – a perspective*".

The round table was moderated by François–Gérard Baron, member of the EUCEET II Management Committee, from the Conseil National des Ingénieurs et Scietifiques de France. Contributions to the round table were brought by Zeljko

Djuretic, Bentley Systems, Yrjö Matikainen, European Council of Civil Engineers, Carlos Bosch, Dragados, Jean François Ravix, Vinci Construction, Prof. Jean-François Thimus, Université Catholique de Louvain and Prof. Bernard Vaudeville, ENPC.

The round table was the last item in the programme of the General Assembly.

In the concluding remarks of Prof. Iacint Manoliu, thanks were addressed to participants for their active involvement in EUCEET activities, to chairpersons of the Working Groups, to key-note lecturers, to the moderator and contributors to the round table, and, last but not least, to Ecole Nationale des Ponts et Chaussées and to Marie-Ange Cammarota, for the continuous and unvaluable support given to the Project.

- *3rd meeting of the EUCEET-Tuning Task Force, Riga, 25 November 2005*

The meeting was organized and hosted by the Faculty of Civil Engineering, Technical University of Riga.

The meeting was attended by the following members of EUCEET-Tuning Task Force: Prof. Iacint Manoliu, Technical University of Civil Engineering Bucharest, Chairman of the EUCEET-Tuning Task Force, Prof. Laurie Boswell, City University London, Deputy Chairman of the EUCEET-Tuning Task Force, Prof. Vaclav Kuraz, Czech Technical University Prague, Prof. Tiit Koppel, Technical University Tallinn, Prof. Pericles Latinopoulos, Aristotle University Thessaloniki, Prof. Vicentas Stragys, Vilnius Gediminas Technical University, Prof. Juris Smirnovs and Prof. Juris Naundzuns, Technical University Riga, Prof. Eivind Bratteland, Norwegian University of Science and Technology, Wojciech Gilewski, Warsaw University of Technology, Jan Bujnak, University of Zilina, Prof. David Lloyd Smith and Colin Kerr, Imperial College London, Prof. Janez Duhovnik, University of Ljubljana, Prof. Nicoleta Radulescu and Prof. Tudor Bugnariu, Technical University of Civil Engineering Bucharest.

The meeting was attended by Prof. Hendrik Ferdinande from Gent University, Tuning expert.

The venue of the meeting was the Latvian Road Administration, Ministry of Transport.

In the opening session, Prof. Juris Smirnovs from the host university introduced to the attendees the Faculty of Civil Engineering of Technical University of Riga.

In the following session, Prof. Iacint Manoliu and Prof. Tudor Bugnariu made a comprehensive review of the results of the surveys undertaken by EUCEET for Tuning.

Prof. Hendrik University from Gent University spoke about “*What the Physics group had been done to the Tuning*”.

In the afternoon session, participants at the meeting brought the contribution of the university they represented for the EUCEET report on findings for the subject area “*Civil Engineering*”.

Concluding the meeting, Prof. Iacint Manoliu thanked to Professors Juris Smirnovs and Juris Naundzuns for the warm hospitability and excellent organization of the meeting.

- *8th meeting of the EUCEET II Management Committee, Nicosia, 5 December 2005*

The meeting was organized and hosted by the Cyprus Association of Civil Engineers and was attended by the following members of the Management Committee:

Prof. Marie-Ange Cammarota, ENPC Paris, EUCEET II Coordinator; Prof. Iacint Manoliu, Technical University of Civil Engineering Bucharest, Management Committee Chairman; Prof. David Lloyd Smith and Colin Kerr, Imperial College London; Prof. Laurie Boswell, City University London; Prof. José Luis Juan-Aracil, Technical University Madrid; Prof. Josef Machacek, Czech Technical University Prague and AECEF; Prof. Peter Ruge, Technical University Dresden; Prof. Ryszard Kowalczyk, University of Beira Interior, Covilha; Prof. Stanislaw Majewski, Silesian University of Technology, Gliwice; Prof. Pericles Latinopoulos, Aristotle University of Thessaloniki; Prof. Antal Lovas, Budapest University of Technology and Economics, Budapest; Prof. Nicoleta Radulescu, Technical University of Civil Engineering Bucharest; Prof. Richard Kastner, Institut National des Sciences Appliqueés Lyon.

The meeting was also attended by Mr. Nicos Neocleous, contact-person from the Cyprus Council of Civil Engineers for EUCEET.

Prof. Iacint Manoliu presented the pre-proposal for a new project EUCEET III sent to the EC on 1st November 2005.

Prof. Marie-Ange Cammarota presented the main lines of the final report for EUCEET II which was due to be sent to EC by 15th April 2006.

Prof. Iacint Manoliu informed members of the Management Committee on the activities of the EUCEET-Tuning Task Force following the General Assembly in Paris.

Concluding the meeting, Prof. Marie-Ange Cammarota expressed thanks to the Cyprus Council of Civil Engineers and to Nicos Neocleous, host of the meeting, for the active involvement and support given to EUCEET.

Annex

Attendance of EUCEET II General Assemblies*

CNTR	NAME	INSTITUTION	Attendance of the GA		
			ATHENS	MALTA	PARIS
			20-21.02. 2003	6-7.05. 2004	29-30.09. 2005
Austria	Stephan SEMPRICH	Graz University of Technology	X		
Belgium	Jean BERLAMMONT	KU Leuven		X	X
Belgium	Ghislain FONDER	University of Liege	X	X	X
Belgium	Hendrik FERDINANDE	University of Gent		X	X
Belgium	Jean-François THIMUS	Université Catholique de Louvain	X	X	X
Bulgaria	Borislav Tzvetkov BELEV	UACEG Sofia	X		X
Bulgaria	Chavdar DONCHEV	UACEG Sofia		X	
Bulgaria	Kosta MLADENOV	UACEG Sofia			X
Bulgaria	Ivan PAVLOV	UACEG Sofia		X	
Bulgaria	Ivan Mihailov TOTEV	UACEG Sofia	X	X	
Canada	Thomas BROWN	University of Calgary		X	
Cyprus	Nikos E. NEOCLEOUS	Cyprus Civil Engineering Ass.	X	X	X
Czech Republic	Vaclav KURAZ	Czech Technical University, Prague	X	X	X
Czech Republic	Jiří WITZANY	Czech Technical University , Prague		X	
Czech Republic	Yveta LINHARTOVA	University of Pardubice	X	X	
Czech Republic	Josef MACHACEK	AECEF	X	X	X
Czech Republic	Alois MATERNA	Technical University of Ostrava	X	X	X
Czech Republic	Hynek SERTLER	University of Pardubice	X	X	
Denmark	Manfred FEDERAU	Engineering College of Odense	X	X	X
Denmark	Carsten S. SORENSEN	University of Aalborg	X	X	
Estonia	Tiit KOPPEL	Tallinn Technical University		X	X
Estonia	Toomas LAUR	Tallinn Technical University	X	X	X
Estonia	Karl OIGER	Tallinn Technical University	X		X
Finland	Aarne JUTILA	Helsinki University of Technology		X	X
Finland	Yrjo MATIKAINEN	ECCE			X
Finland	S. HANNINEN	Helsinki University Technology; IABSE		X	
France	François Gérard BARON	CNISF		X	X
France	George PILOT	CNISF	X	X	X

France	Françoise BOURGAIN	Ecole Nationale des Ponts et Chaussées, Paris			X
France	Marie-Ange CAMMAROTA	Ecole Nationale des Ponts et Chaussées, Paris	X	X	X
France	Jean-Jacques COLLEU	Ecole Nationale des Ponts et Chaussées, Paris			X
France	Philippe COURTIER	Ecole Nationale des Ponts et Chaussées, Paris			X
France	David CHUPIN	Ecole Nationale des Ponts et Chaussées, Paris			X
France	Jorg ESCHENAUER	Ecole Nationale des Ponts et Chaussées, Paris			X
France	Roger FRANK	Ecole Nationale des Ponts et Chaussées, Paris	X	X	
France	Bernard GAMBINI	Ecole Nationale des Ponts et Chaussées, Paris			X
France	Adnan IBRAHIMBEGOVIC	Ecole Normale Supérieure Cachan	X	X	
France	Valérie JOLY	Ecole Nationale des Ponts et Chaussées, Paris			X
France	Alain NEVEU	Ecole Nationale des Ponts et Chaussées, Paris			X
France	Jean Y. POITRAT	Ecole Nationale des Ponts et Chaussées, Paris		X	
France	Thibaut SKRZYPEK	Ecole Nationale des Ponts et Chaussées, Paris			X
France	Bernard VAUDEVILLE	Ecole Nationale des Ponts et Chaussées, Paris			X
France	Elizabeth VITOU	Ecole Nationale des Ponts et Chaussées, Paris			X
France	Marie-Jo GOEDERT	ESTP			X
France	André MOREL	ESTP			X
France	Richard KASTNER	INSA Lyon	X	X	X
France	Jacques LERAU	INSA Toulouse	X		
France	Bernard LE TALLEC	Institut Supérieur du Béton Armé	X	X	X
France	Jean-François RAVIX	VINCI construction			X
Germany	Carsten AHRENS	Fachhochschule Oldenburg	X	X	X
Germany	Ulvi ARSLAN	Technical University Darmstadt	X	X	
Germany	Guenter HEITMANN	Technical University Berlin	X		X
Germany	Ralf REINECKE	IB - REINECKE	X	X	X
Germany	Peter RUGE	Technical University Dresden		X	X
Germany	Carolin TRINKS	Dresden University of Technology	X		
Greece	Dimitios ATMATZIDIS	University of Patras	X		
Greece	Stefanos DRITSOS	University of Patras	X		
Greece	Pericles LATINOPOULOS	Aristotle University of Thessaloniki	X	X	X
Greece	Erikos MOURATIDIS	TEI of Serres			X
Greece	Demetrious PAPAGEORGIOU	TEI of Piraeus	X	X	X
Greece	Theodossios PAPALIANGAS	TEI of Thessaloniki	X		

Greece	Panos PAPANICOLAOU	University of Thessaly	X		
Greece	Marina PANTAZIDOU	National Technical University of Athens	X	X	X
Hungary	Anikó CSÉBFALVI	University of Pécs	X	X	X
Hungary	Gyorgy FARKAS	Budapest University of Technology and Economics		X	X
Hungary	Antal LOVAS	Budapest University of Technology and Economics	X	X	X
Ireland	Paul FANNING	Institution of Engineers of Ireland	X		
Ireland	Brendan O'KELLY	Trinity College		X	X
Ireland	Bruce MISSTEAR	Trinity College	X		
Ireland	Catherine O'SULLIVAN	University College Dublin		X	
Italy	Giuliano AUGUSTI	University Roma I			X
Italy	Alberto CORIGLIANO	Politecnico di Milano	X	X	X
Italy	Franco MACERI	Universita di Roma "Tor Vergata"	X	X	X
Italy	Giorgio NOVATI	University of Trento	X		X
Italy	Diego LO PRESTI	Politecnico di Torino	X	X	X
Latvia	Juris NAUDZUNS	Riga Technical University		X	X
Latvia	Juris SMIRNOVS	Riga Technical University	X	X	
Lithuania	Vincentas STRAGYS	Vilnius Gediminas Technical University	X	X	X
Lithuania	Inga VEZEVICIENE	Vilnius Gediminas Technical University			X
Malta	Spiridione BUHAGIAR	University of Malta	X	X	
Netherlands	C.J.A. van DUREN	Technical University Delft			X
Netherlands	Kees van KUIJEN	Technical University Delft			X
Netherlands	Hellen TOUW	Technical University Delft		X	
Netherlands	Helena WASMUS	Technical University Delft		X	X
Netherlands	Jean-Pierre CHANNARD	Bentley Systems			X
Netherlands	Zeljko D JURETIC	Bentley Systems			X
Netherlands	Andrea VAN der LOOS	Bentley Systems			X
Norway	Eivind BRATTELAND	Norwegian University of Science and Technology Trondheim	X	X	X
Norway	Lars JUTERUD	Federation of Norwegian Construction Industries		X	
Poland	Wojciech BANKOWSKI	Road and Bridges Research Institute (IBDM)	X	X	X
Poland	Wojciech BARANSKI	Technical University of Lodz	X	X	
Poland	Piotr BERKOWSKI	Wrocław University of Technology	X	X	X
Poland	Jan BIEŃ	Wrocław University of Technology	X		
Poland	Wojciech GILEWSKI	Warsaw University of Technology	X		X
Poland	Maria KASZYNSKA	University of Szczecin		X	
Poland	Barbara KLISZCZEWICZ	Silesian Technical University		X	X

Poland	Ryszard KRYSTEK	University of Gdansk		X	
Poland	Andrzej LAPKO	Bialystok Technical University	X	X	X
Poland	Stanislaw MAJEWSKI	Silesian Technical University	X	X	X
Poland	Elzbieta PRZESMYCKA	Technical University Lublin			X
Poland	Szczepan WOLINSKI	Rzeszow University of Technology	X	X	X
Portugal	Luis CALADO	Instituto Superior Técnico Lisbon	X	X	
Portugal	Jose COUTO MARQUES	Universidade do Porto			X
Portugal	Joao FONSECA	University of Beira Interior, Covilha	X		
Portugal	Jose F. GOMES MENDES	University of Minho	X	X	
Portugal	Ryszard KOWALCZYK	University of Beira Interior, Covilha	X	X	X
Portugal	Luis Jaoquim LEAL LEMOS	Universidade de Coimbra	X		
Portugal	Luis Alberto SIMOES DA SILVA	Universidade de Coimbra	X	X	
Portugal	Pedro SÊCO e PINTO	LNEC	X		
Romania	Anna Maria SCHIAU	INCERC Bucharest	X		X
Romania	Ion BERCA	PROCEMA Institute -Bucharest	X		
Romania	Vasilica DIMA	PROCEMA Institute -Bucharest			X
Romania	Paulica RAILEANU	Technical University "Gh.Asachi" Iasi	X	X	
Romania	Nicolae TARANU	Technical University "Gh.Asachi" Iasi		X	
Romania	Doina VERDES	Technical University Cluj-Napoca	X	X	X
Romania	Tudor BUGNARIU	TUCE Bucharest	X	X	X
Romania	Anton CHIRICA	TUCE Bucharest			X
Romania	Iacint MANOLIU	TUCE Bucharest	X	X	X
Romania	Alexandrina PRETORIAN	TUCE Bucharest	X		
Romania	Nicoleta RADULESCU	TUCE Bucharest	X	X	X
Romania	Laurentiu SONIA	TUCE Bucharest			X
Romania	Dan STEMATIU	TUCE Bucharest		X	
Romania	Mihai VOICULESCU	TUCE Bucharest			X
Romania	Virgil BREABAN	University "Ovidius" Constantza	X	X	
Romania	Iuliu DIMOIU	University "Politehnica" Timisoara		X	X
Russia	Vladimir ANDREEV	Moscow State University of Civil Engineering		X	X
Russia	Vladimir GAGIN	Moscow State University of Civil Engineering			X
Slovakia	Jan BUJNAK	University of Zilina	X	X	X
Slovakia	Jozef DICKÝ	Slovak University of Technology in Bratislava	X	X	X
Slovakia	Stanislav UNCIK	Slovak University of Technology in Bratislava			X
Slovakia	K. KALDARAN	SCCE, Bratislava		X	

Slovenia	Matej FISCHINGER	University of Ljubljana	X	X	
Slovenia	Miroslav PREMROV	University of Maribor		X	X
Spain	Julia ALVAREZ	Universidad de la Coruña		X	
Spain	Juan CAGIAO VILLAR	Universidad de la Coruña			X
Spain	Rafael BLAZQUEZ	Universidad de Castilla La Mancha	X	X	
Spain	Luis Jose JUAN ARACIL	Universidad Politecnica de Madrid	X	X	
Spain	José Antonio REVILLA	Universidad de Cantabria, Santander			X
Spain	Soledad NOGUÉS LINARES	Universidad de Cantabria, Santander	X	X	X
Spain	Pedro SERRANO	Universidad de Cantabria, Santander			X
Spain	Xavier SANCHEZ-VILA	Universidad Politecnica Catalunya, Barcelona	X	X	X
Spain	Ricardo Diaz ZOIDO	Universidad Politecnica Catalunya, Barcelona	X		
Spain	P. RODRIGUEZ	School of Civil Engineering of La Coruna	X		
Spain	Carlos BOSCH	DRAGADOS			X
Spain	Juan ELIZAGA	Ferrovial-Agroman		X	
Turkey	A. Mehmet HAKSEVER	Istanbul University			X
Turkey	Ismail YAMAN	Middle East Technical University			X
UK	Laurie BOSWELL	City University of London	X	X	X
UK	Colin J. KERR	Imperial College London	X	X	X
UK	David LLOYD SMITH	Imperial College London	X	X	X
UK	Ian MAY	Heriot Watt University	X	X	
UK	Mohammed RAOOF	Loughborough University	X	X	X
USA	Maria HAUSEN	Northwestern University			X
USA	Andrzej NOWAK	University of Michigan	X	X	

*The alphabetical order of countries was adopted

Report of the
Working Group for the
Specific Project 5

Problem-oriented, project-based education in civil engineering

PROBLEM-ORIENTED, PROJECT-BASED EDUCATION IN CIVIL ENGINEERING

Preface by *Eivind Bratteland*[1],

Coordinator for Theme B "*Development of the teaching environment in civil engineering education"*

The issues of Special Project 5 on Problem-oriented, Project-based Education in Civil Engineering are clearly challenging and complex. This complexity could be illustrated by the introduction of P5BL at Stanford University, covering "Problem – Project – Product – Process – People – Based Learning". Various approaches and forms can be taken within PBL to promote learning, and PBL is often considered both a process and a tool in this context.

With its focus on learning environment, student-perspective and -responsibility, PBL can be linked to and assessed in relation to international trends and issues, such as have been explored most recently by the Thematic Network E4 (Enhancing Engineering Education in Europe), and by Tuning (Tuning Educational Structures in Europe).

To facilitate a broad outlook into the complex PBL-arena, and to allow for various opinions to be voiced, it was finally decided to cover the extensive work done in the working group by two reports. These two reports complement each other, and illustrate the variety and flexibility that is rendered possible when the PBL-concept is applied creatively in an educational and learning process.

Part 1 describes approaches to and discussions on PBL as favored by many of the SP5 Working Group members, while part 2 takes a somewhat different approach and also provides examples from institutions where PBL has been implemented in one form or another. While laying no claim to completeness, these reports give clear insight into the range of learning approaches, outcomes and student cognitive styles that can be addressed and satisfied within a PBL-concept.

[1]Professor, Norwegian University of Science and Technology Trondheim, Norway

Part 1: Report by *Manfred Federau*[2]

1. MISSION

This paper is a report of the team formed to work on specific project SP5 under theme B of EUCEET II. Theme B is entitled **"Development of the Teaching Environment in Civil Engineering Education"** and SP5 was given the working title: **"Problem-oriented, Project-based Education in Civil Engineering"**.

1.1 Objectives

The terms of reference put down before the beginning of the work say: "A major objective for theme B is to *identify and assess the most important elements and variables* included in a good teaching environment. Related to this, Specific Project 5 shall focus on the *problem-oriented and/or project-based education* as a *basis* for adopting new developments, strategies and tools in civil engineering education, to improve student learning and to provide a learning environment with integrated efforts from teachers, students and preferably also the industry. *Important challenges and key components should be identified and discussed*, and *examples of good and workable practices illustrated*".

In the SP5 Working Group (hereafter abbreviated WG) it is a strong feeling that PBL is especially applicable in civil engineering education. Furthermore, since the use of PBL is not widespread in CE education, the WG sees it as important objectives to

– Motivate colleagues to experiment with using an approach inspired by problem/project organised education in their delivery.
– Facilitate colleagues and institutions who want to initiate implementation of such education by pointing out *operational* parameters.
– Create reflections on the applicability and efficiency of such initiatives amongst colleagues who have used it in one or more of its many variants.

The WG will break down problem driven methods into elements that characterize them and distinguish them from "traditional" education.

– in the context of this report "traditional" education means purely lecture-driven education, i.e. the method commonly used in engineering education and particularly civil engineering education: Lectures, often in large fora, heavily based on "going through" examples, handing out worked examples, combined with tutorials and example-based homework.

In the same way, the WG will search for variables influencing the learning climate. Furthermore, rather than mearly to "*assess* the most important elements and variables included in a good teaching environment" the WG will attempt to put forward *characteristic consequences* of using PBL in civil engineering education.

1.2 Meaning of Concepts

The WG has decided to use the abbreviation PBL when referring to the main

[2] Professor, Odense University College, Denmark

concept discussed in this project. Despite the fact that PBL stands for "Problem-based Learning" the WG does not think there will be any risk of misunderstanding its mission. However, in order to put things in the right perspective, the following should be borne in mind:

- Education can be organised in a way that turns the learning environment into being problem-based, i.e. one must distinguish between problem-organised education (education by means of presenting (a series of) problems – lecturer's viewpoint and problem-based learning (learning by finding answers – student's viewpoint).

Likewise, there is much uncertainty about how to define the concept of "project".

- Even "projects" that cover more than one semester of work load for the students can still be considered as a (big) problem or a series of problems. What is more interesting is that when "teaching" takes place in a problem-organised environment, the learning will be problem-based (problem-driven). Therefore, the distinction between "project-organised" and "problem-organised" is more a question of how a certain piece of education is organised.
- In short: When this paper talks about "-organised" it means the way in which education is arranged (or intended to function) - by the organisation (very often by the educator in question).

1.3 Working Group Members and Group History

The WG was formed at the first General Assembly of EUCEET II which took place in Athens 20 - 21 February 2003. Twenty-five GA delegates attended the meeting where the terms of reference and working methods were discussed. The Management Committee had appointed **Eivind BRATTELAND** of Norwegian University of Science and Technology (NTNU, Trondheim, Norway) to chair the WG. During the meeting **Manfred FEDERAU** of IOT (Odense, Denmark) was elected vice chairman. The plans for setting up a special home page for filing input from WG members at NTNU was brought forward and it was decided to keep in contact through e-mail.

In the period between the first and the second General Assembly of EUCEET II the WG held two meetings, one in Ciudad Real on 20 September 2003 and one in Odense on 5 - 6 March 2004. During these meetings the progress of the work and the outlines of this report were discussed. Furthermore, in this period a core of members who attended more meetings and/or delivered input or substantial commentary on WG work - emerged. Alongside the chairman and vice chairman this core group were:

Marina PANTAZIDOU of National Technical University of Athens, Greece **Hans NOPPEN** of Delft University of Technology, The Netherlands **Helena WASMUS** of Delft University of Technology, The Netherlands **Ghislain FONDER** of University of Liege, Belgium **Jan BUJNAK** of University of Zilina, Slovakia **Bram BRUER** of Windesheim University, The Netherlands (non EUCEET partner)

In addition, the following academics delivered input, commented on the work or contributed in other ways:

Carsten S SOERENSEN of Aalborg University, Denmark Mauritz ERTSEN of Delft University of Technology, The Netherlands Brendan O'KELLY of Trinity College, Eire Matej FISCHINGER of University of Ljubljana, Slovenia Bruce MISSTEAR of Trinity College, Eire Ralf REINECKE of IB Reinecke Ingenioerbuero fuer Tragwerksplanung, Germany Jan BIEN of Wroclaw University of Technology, Poland Konrad ZILCH of Technische Universität München, Germany Ryszard KOWALCZYK of University of

Beira Interior, Portugal Wojciech GILEWSKI of Warsaw University of Technology, Poland Malgorzata GLADYZS of Wroclaw University of Technology, Poland Borislav BELEV of UACEG, Sofia, Bulgaria

On 10 December 2003, Eivind Bratteland informed the chairman of the Management Committee, Iacint Manoliu and the coordinator, Marie-Ange Cammarota, "that, due to health problems, he could no longer act as Chairman of the WG". **Manfred Federau was appointed chairman** of the WG and, at the Odense Meeting, **Marina Pantazidou was elected vice chairman.**

The WG had a brief meeting in Malta on 6 May 2004 during the second General Assembly of EUCEET II. Eleven group members were present and another eight non-members who were informed about the work of the WG.

The idea of using the mapping tool described in section 3 has been brought forward by Manfred Federau who also is responsible for writing this report. Marina Pantazidou has done the research on "examples of PBL applications".

The final draft of this report was circulated for comments 17 September 2004. After corrections had been made according to the members' comments, the final report was circulated 16 October 2004. Due to disagreement with the content of the report, Eivind BRATTELAND 10 November 2004 announced his withdrawal from the WG.

2. THE CONCEPT OF PROBLEM-BASED EDUCATION AND LEARNING

The WG has found it necessary - before even trying to predict any consequences of using PBL - to study in detail the elements that characterise the method, i.e. to define and put words on important ingredients of the method. Figure 1 is used for this purpose.

For many reasons it will prove useful to realize that *education and not the graduate is the product*. Education is produced and developed to attract *customers*, i.e. *students*. In this way conducting quality assurance will prove much more well defined.

There is nothing wrong in regarding the graduate as the product, and most employers certainly do this - and for obvious reasons. However, when discussing the impact of organisation on the learning climate, this is just not practical.

The customer, in this case the student, is placed in the centre of the process. The product (education) is there to assist the customer to reach certain competences, the level and content of which (the learning objectives) is set by the educational institution in question. In figure 1 it looks as if the process is concentrated on the group of students working on the assignment. However, the student is part of the group, and he or she should see the group as a necessary forum for professional development and learning.

– As defined in this paper problem-based education is always organised with working groups as the principal means for communication between staff and student. Further more, the following factors are important:
  - group size
  - group climate (norms)
  - group leadership
  - formation of the group (selection of group members).

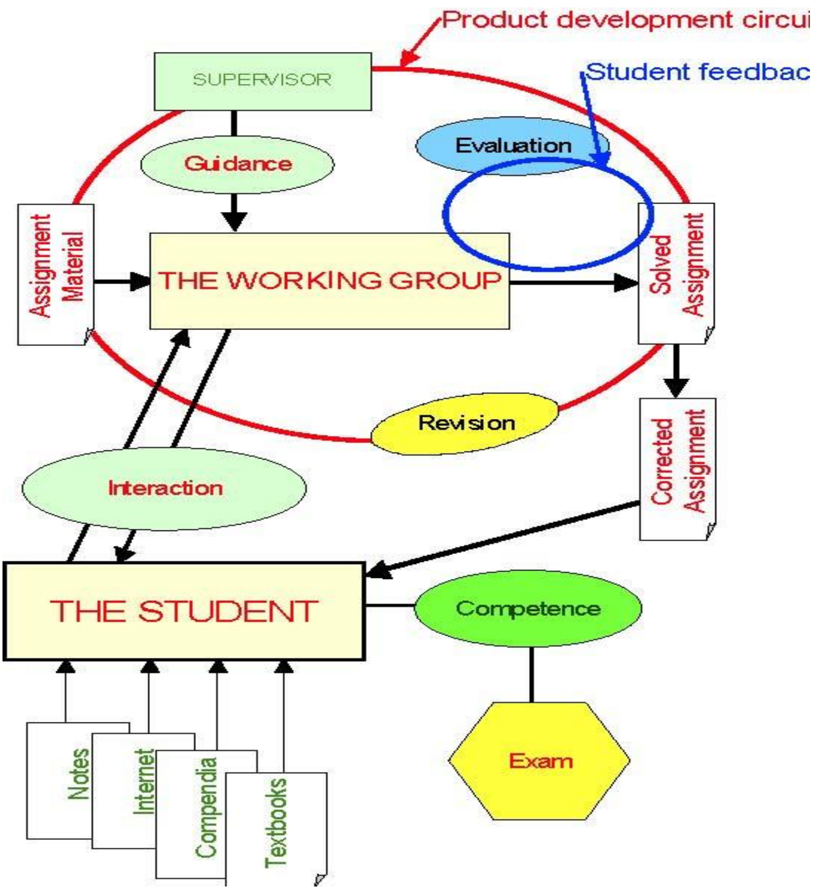

Figure 1. The elements in PBL

Another important "ingredient" is the assignment material, the written "contract" between the institution (or the educator in charge) and the student, i.e. most typically the group. In all variations of PBL the student is "faced with" a problem, a series of problems or a series of questions. Assignments can have a great variety of forms, reaching from a mere heading to very detailed lists of problems or questions that the student must solve/answer. In extreme cases, students are even asked to formulate the assignment(s) themselves, sometimes even to decide the theme of the assignment.

– As defined in this paper problem-organised education is always characterised by using an assignment in written form as the "deal" between student and organisation. The following factors should be considered:
  - quality of the assignment. Does it live up the goals set for the course unit?
  - degree of specification of the task
  - degree of detail in description of the assignment
  - demonstration of transferable skills - possible demands on the form in which the finished work should (must) be filed
  - the deadline(s) for filing the work or parts of the work

  - rules for or policy of correction of the filed work
  - procedure for revising the assignment after each run, and
  - quality assurance. Policy for making the product transparent, i.e. making the assignment and all other important paper accessible (via the organisation's intranet or the Internet) to all interested parties.
- Evaluation is a key point. This means that the student must experience frequent feedback on his or her progress. It also means that the person in charge of the education must be ready to revise the assignment material continuously: It is very unlikely that the material used in the first cycle will work perfectly.
  - It must be decided if the student's efforts should also be marked continuously and how this should influence the final marking of the student for the whole course unit. This should, if the institutions policy in this area allows it, be done in a fully transparent system.
  - If the assignment is broken down in smaller "packages", all of which will be subject to correction and/or comments (respectively marking), the feedback process can become more frequent and more formalised.

Compared with traditional teaching the role of the teacher changes dramatically. The form and quality of guidance will have a significant impact on the learning outcomes.

- Policy on guidance and control over staff competence in this respect is an important factor of product quality. The teacher's attitudes and his or her personal and social competences will have a more direct influence on the learning outcomes.

Exams, i.e. their form and the way they are performed or, more precisely, the student's expectation in this respect, will have a heavy influence on learning outcomes.

- All forms of exams can be used when course units are run using PBL, but not necessary with the same effect on the learning process:
  - Form. Written, oral, presentation or?. Individually, as a team or?
  - Marking system. Graded system, passed/not passed, accepted/not accepted, etc.
  - Group or individual examination/marking?
  - Should filed material (reports, etc) be part of the evaluation and marked with a certain weight in calculating the overall mark?
  - Need filing of finished assignments be mandatory? (Or should they be regarded as a means of learning?)

In the following, these elements of PBL will be used in the attempt to create a model for describing the characteristics of the problem-based learning environment.

3. DEFINITIONS AND VARIABLES

3.1 Conditions

Before beginning to state various variables and discuss their applicability, it is necessary to state some conditions:

For a given course unit the professional content, the academic level and the level of educational quality must all be regarded as boundary conditions.

- It is true, however, that the applicability of PBL can vary with subjects. For instance, one could ask if it is possible to teach say mathematics in a problem-driven way and, if yes, to what degree. However, it is the feeling that the variables developed must be usable in all degrees of implementation and use of PBL.

Likewise it is highly possible (and should be favoured) that the composition of content will change.

- The academic level must be regarded as something fixed by the management of the institution in question.
- The level of teaching quality and learning outcomes are measured by the extent to which goals and targets set by the institution are fulfilled.

3.2 Competences versus qualification

PBL is different from traditional teaching in many ways. One important difference is that it focuses, or should focus on *competences* instead of just *qualification*. Qualification is something a student per definition has after passing a certain course – in this case in civil engineering.

- Competence is defined here as the ability to solve a certain practical or theoretical problem. For further insight in this important issue, see Poulsen 2001.
- In some languages/cultures, competence can mean “having the right or legality to give orders or take certain decisions”. This meaning of the concept is not an issue in this paper.

It can be argued that a person can be qualified to apply for a job without possessing the competences necessary to fill the job. Likewise, in the world of today it is often seen that people are hired based on their merits (read competences) more than their “official” qualification (exam papers). Using PBL can be seen as the education “industry” taking up this challenge.

Traditional education is known to focus specifically on professional competence, whereas PBL is heavily focused *also* on competences other than professional competence. The most important factor is the student’s development of his or her *Learning Competence*, which is the major motive for using PBL as a tool for learning. Another important motive is to make the student more self-sufficient, to make the student realise that he or she has a great deal, if not all, responsibility for his or her own learning. The idea is to “create room for learning”, to sharpen the student’s self confidence when it comes to tackling “difficult” concepts. It appears that many students find it difficult to read and understand difficult texts, a problem well suited to be solved using PBL. However, it goes further than that: defining problems, mastering the combination of “tools” necessary to solve them and producing clear and well-structured documentation of suggested solutions are all examples of skills that can be developed efficiently by using PBL.

Furthermore, the idea is to use this factor as an engine for motivation. There is a major and growing demand for focus on learning competences from employers and from society as well, viewed in the light of the need for life-long learning.

Another factor that can be viewed individually is that of personal competence, which is about transferable skills, but also includes use the IT, social skills, such as working in a group, taking leadership, maturity in behaviour, etc. The impartation of these skills has a growing importance for the graduate’s degree of success especially in his or her first job.

3.3 Projects and problems

In everyday language, the concept "project" can be many things: it can mean just any assignment. In education, the concept is usually – but not necessarily - linked to group organised student activity and can stretch from very small, clearly defined problems to large, theme-based assignments lasting for months or a semester. "Purists" only use the label "project" on "open-ended" problems, i.e. only problems having a plurality of solutions can be regarded as projects. Sometimes these "pure" projects are given students as assignments only by a specific heading or – even more open – as a theme.

In this paper, the concept of projects must stretch from all but the simplest exercise problem over what is known as course work to more open-ended assignments.

Others state that a project in education can only be accepted as such if the problem(s) are of a "real life" character. The reason for this is that such assignments are meant to have stronger motivational drive. However, it can be very difficult to find suitable real life project assignments, i.e. they can be too trivial, and sometimes it is necessary to modify or even construct assignments in order to meet the demand for a certain professional content and/or a certain academic level. Also, it must not be forgotten that if the purpose of "doing" a project is its learning value, using material only because it is an example from "real life" could mean a drop in quality.

Final (Degree or Diploma) projects are somewhat different in this respect. Although it is certainly true that students learn a lot from doing this kind of work, it can be stated that the main purpose with these projects still (at least in an ideal world) is to give the student an opportunity to demonstrate his or her professional competence and, from the institutions point of view, an important evaluation tool.

The concept "problem" should not need further discussion. However, since problem solving – and training in this discipline – has a heavy impact on engineering education it is necessary to state that the term "problem-based" only applies to situations where solving problems, answering questions, doing specific lab or field work, etc. is used as a *deliberate tool* for developing the students' *learning competences,* i.e. learning should be problem-driven. The student must feel that "the problem" is to *understand* rather than to *accept* knowledge without further reflection, to be able to combine previously learned knowledge and to be able to see problems in greater entirety.

3.4 The Learning Climate Model

In order to describe the influence of managerial instruments on the learning climate as perceived by the student, the WG embraced the idea to develop a model. Since it is not possible to describe a learning climate as a function of just one "predominating" variable and since many variables can influence the learning climate (see also 3.5), figure 2 will be used to illustrate the impact on the learning climate of different ways to organise teaching.

The decision of what to choose for axes was a difficult one, mainly because it was difficult to find single words that covered the concepts sought for. Therefore the concepts "Assignment Freedom" - the ordinate - and "Active Problem Drive" - the abscissa - are given thorough clarifying description below.

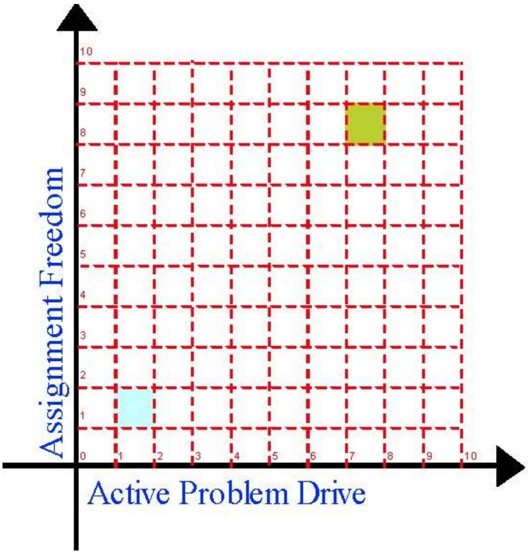

Figure 2. The Learning Climate Grid

The intention is *not to assess* a certain piece of education as being “good” or “bad” but merely to answer the two questions:

– How “project-organised” is it?
– How “problem-driven” are the teaching tools used?

The score, i.e. the (x,y) or (PD,AF) value, will then give an indication of how “project-oriented” and how “problem-based” the learning situation and learning climate are.

It is important to stress (not only because it has been the reason for much “heated” discussions in the WG) that a learning climate cannot be given by a function of the type y = f(x).

The values AF and PD cannot be measured directly - they are determined by a series of organisational variables, of which some important ones are described below in section 3.5.

The *ordinate* is quite straightforward to explain. This is about how much the lecturer (supervisor, management) allows the student(s) to choose methods and sometimes areas of work. Solving “exercise problems” in say mathematics will certainly have a very low AF value, while open-ended projects without any demands on outcomes other than pursuing a certain theme will have AF values close to 10.

If a project like “design a bridge stretching from A to B” is given to students not having acquired knowledge other than in math, physics, materials, CAD, basic structural analysis, etc. this is certainly a piece of education with a very high AF-value. The meaning with this approach – *project organised teaching in its purest form* - is that necessary skills must be developed and learned concurrently with the need for this in fulfilling the assignment. In this way, students are “forced” to study independently and will see knowledge and understanding as a whole and as a necessary means. A piece of education like the one described here will certainly also have a high degree of active problem drive (see below).

In the case of a bridge (as above) the type of bridge (motorway -, road -, pedestrian, etc. bridge) will usually be given by the circumstances. If not the assignment could be narrowed (more specified), say into "design a footbridge stretching from A to B", the AF value will drop, while the PD may remain unchanged. The effect can be changed further into ".. a steel footbridge .." or ".. a steel girder footbridge ..". In its most specified form this type of assignment is known as *coursework*.

Since simply using the term "Active Problem Drive" could lead to many different interpretations, defining the abscissa values needs more attention.

– The major idea of using PBL is *actively to urge* – one could say "force" – the student to develop his or her ability to "tackle" difficult concepts, to combine previously obtained knowledge and to take more responsibility for own learning. This means that abscissa values can be understood as the *degree of focus on the students development of his or her learning competence* implemented by the person(s) in charge of the course unit in question.

– The axis can be said to have the extremes: Purely lecture-driven education and autonomous learning.

– Group member Hans Noppen: Low values means "you give the students a cookery book", high values that "you give them a toolbox".

– Likewise PD-values can be understood as the student's "degree of initial unpreparedness".

What can the model be used for?

It is the hope of the WG that the Learning Climate Grid can serve as a "common language" when referring to PBL. It should be possible with this tool to place certain ways of organising PBL in an operational context. In the following examples, known and new concepts will be described using the variables in the grid.

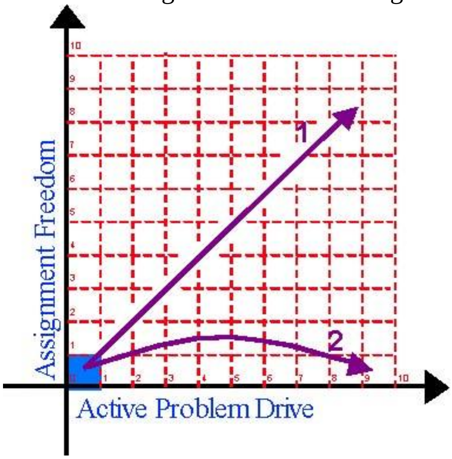

Figure 3

The grid can be used to describe the development from traditional, lecture-driven education gradually towards project organised, problem-driven education (line 1, figure 3) or towards using PBL in non-project organised course units (line 2, figure3).

Since it is probably not possible to "place" a certain piece of education precisely in the grid, a subdivision as shown in figure 4 could be useful. The possibility of placing a situation in one of the quadrants could help the development of a common PBL language.

The (PD,AF) value (0,0) describes traditional, lecture-driven education but the *first quadrant* as a whole equals a situation where some attempts have been made to make learning more problem-driven. If group work is applied it can be project organised, at least to some extent.

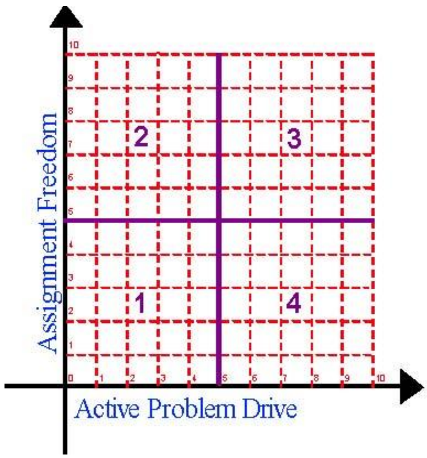

Figure 4

The learning climate of the *third quadrant* is what is usually understood by PBL: A high degree of focus on the development of learning competence (problem drive) and at the same time also of personal competence by implementing project parameters.

The *fourth quadrant* describes a situation probably not so well known: Highly problem-driven education with little or no use of project parameters. The education is group-organised with little or no lecturing. Very often discipline oriented education is found here.

The *second quadrant* describes a situation where high emphasis is placed on using project parameters, but also where the full advantage of problem drive not is taken.

Below is given a more detailed description of operational variables determinating the “placing” of pieces of education.

Before beginning to describe and support by examples the use of the grid, it is necessary to state one key issue: The fact that the main purpose of this paper is to attempt to identify the concept of PBL could lead to misunderstanding. However, **THERE IS NO “BEST PLACE” IN THE GRID**. The applicability of a certain combination of variables changes from situation to situation, with the lecturers’ ability and approach, from subject to subject, with students’ “seniority” in the system, as a function of the “subject” (f. ex. mathematics versus design), etc.

3.5 Operational Variables

Many variables will influence the learning climate. What is sought here is firstly variables which are operational: they must be parameters controlled by either management or the educator(s) in charge of the piece of education in question. Furthermore, they must be parameters that can be documented, making assessment of the learning climate possible.

The WG is fully aware of the fact that there are other important parameters involved. Many of these have an intrinsic nature and can therefore have a great impact on the motivational drive in an educational situation. Some of these parameters will be mentioned towards the end of this section.

Table 1 shows a list of operational parameters. The mentioned effects on the PD- and AF-values of the educational grid are the WG's *initial* assumptions. It is quite clear that the effects should be graduated, the strength of the variables will result in effects that can be not just "yes" or "no" but: *"not at all", "possibly not", "in some degree" or "definitely"* and so forth. It may even be possible to measure the *strengths* of effects more precisely (fx. using values on a scale from 1 to 10). It is the intention of the WG to work on the tuning of this tool and possibly present the results in an addendum to this report. In the following, an introduction to this work will be given in the form of short descriptions of the WG's perception of the effect of the variables.

Table 1. Educational Grid Variables

Variable	**Effect on PD**	**Effect on AF**
1. Student influence on content	no	yes
2. Degree of prior knowledge	yes	yes
3. Introduction to group work	yes	yes
4. Guidance policy	yes	no
5. Assignment structure	no	yes
6. Student delivery	yes	no
7. Exams	no	yes

3.5.1. Student influence on content

This factor is of great importance in describing the degree of project organisation. In traditional education students have little or no influence on the professional content of a course unit. If the group work used in the course unit has the character of being exercise or course work there will be no contribution to the AF value, whereas, if the students have much or total control of the content, the contribution will be higher. The use of this variable is meant to underline the fact that not all types of group-organised student work can be categorised equally in this respect. This factor has no direct (isolated) impact on the PD value.

> In short: If you want a high degree of project organisation, let the students decide as much as possible of the professional content.

3.5.2. Degree of prior knowledge

This variable has a heavy influence on the degree of how problem-based a piece of education is. It has also smaller influence on the AF-value. If the students have no prior knowledge of the professional content intended to be contained in the course unit the “need” (motivation) to develop learning competence will be very strong, just as the pressure on developing the skills needed for organising and “solving” a project. If the students are lectured beforehand on the content (“subject(s))” in question both the AF and the PD values will be reduced. Furthermore, if the area is “backed up” by going through examples - which by the way is very common in traditional engineering education - both the AF and the PD values will drop further.

> In short: If you want a high degree of project organisation, and at the same time create a high degree of problem drive and a high focus on learning competence, then realise that presence of prior knowledge will reduce this effect.

3.5.3. Introduction to group work

This factor will also influence the values measured by both axes - probably the PD value more than the AF value. In an ideal world, all necessary information to the student should be put down in the written assignment - the “deal” between educator and student. If more introduction is needed, it is a sign of a misunderstood attempt to “help” the students. It will inevitably result in a reduction in the student’s need for (motivation to) “finding out how, why and what to learn” and certainly also reduce the need for developing skills in “monitoring, structuring and organising” a project.

> In short: If you want to put a strong emphasis on learning competence and at the same time strengthen the project organisation of a piece of education, then produce a written assignment that can stand alone. Furthermore, plan the “pathfinder” part of it to match the situation and the ability of the students.

3.5.4. Guidance policy

If the lecturing is moved to the group room, nothing is gained except loss of quality. Students inexperienced with PBL often claim that PBL is “inefficient” and they will ask for “education”, meaning lectures. The supervisor must urge the students to use the full dynamic power of the group and only “solve” their problems when the group is in a deadlock. He or she must first and foremost guide the students by explaining only principles and by showing where “missing” knowledge can be found. The supervisor must learn to tackle questions like: ”Which *formula* should be used to answer this question (or to solve this problem)?” or: “Why don’t you just tell us *what* you want us to do?” or: “*How* do you want us to do this?” He or she must use effort on explaining *why* the question or problem is there. If the supervisor feels that guidance needs to go beyond being on “a need to know basis” the advantage of teaching in groups is, that more detailed guidance can be given individually. This factor only works on the PD-axis.

> In short: If you really want to urge students to develop their learning competence, then *never answer a question that has not been asked*. Remember that any form of lecturing does exactly that!

3.5.5. Assignment structure

It is quite clear that the more detailed the written assignment is and the more demands there are on form, amount and quality of the output of the group work, the less project-organised it will be. It is also important to emphasise that project-organised group work is not problem-based by definition. Therefore, this factor only works on the AF-value.

> In short: If you want your group work to function with a high degree of project organisation then use a very loose structure in the assignment and keep the demands on output very open.

3.5.6. Student delivery

In project-organised education the learning outcome is often thought to be synonymous with the (professional and transferable skill-wise) quality of "the project", the delivery of the group or the student. It is quite normal that delivery quality also has an impact on the final marking of the student - or the group. However, it is often overlooked that such an intention can have a negative effect on the problem drive value. If the group knows that the final marking will more or less depend on the character of their delivery, the students will concentrate on "getting the right answer(s)" rather than on understanding the scientific principles behind the solution(s) presented in their delivery. At the same time the tendency towards using division of labour will grow and the distribution of learning outcome therefore tend to be uneven.

The same can be said about the use of sophisticated presentation tools, such as "desktop publishing" and PowerPoint. Sometimes, however, this could be the substance of a project, and in this case the assignment must state the demands on learning outcome as far as transferable skills are concerned.

If, on the other hand, the students feel that they are measured individually on the competences they have gained through fulfilling the course unit in question, then the drive value will increase. This factor, the emphasis put on delivery, can be graduated. Ultimately - and alas only in non project-organised circumstances - delivery can be non compulsory. The students will then feel that mistakes sometimes are there to learn from, and therefore can be useful. At the same time each student will feel a growth in individual responsibility for their own learning.

> In short: By tuning the policy around student delivery, management or the person in charge of project-organised units can move the learning climate into, or deeper into, the third quadrant of the educational grid. In non-project organised education, it is a must to regard the student delivery primarily as a means for feedback and therefore mainly as a tool for learning.

3.5.7. Exams

The form of and the manner in which exams are performed has a heavy impact on student behaviour and in this respect problem-driven education is not different. PBL is specific in the sense that it is group-organised and that it contains a delivery (see above) that can influence the form and course of the examination. The combination of high emphasis on delivery quality and low degree of individuality in examination may work well in project-organised education. The students may even regard this as "fair and good". It will, however, have the effect mentioned above. In non project-organised education there is more freedom, with the above-mentioned consequences.

Another characteristic in group-based education is that the degree of individuality in both examination and marking can be varied. Again there is a difference between project organised and non-project organised education. In the first case, it can be an important intention to train the student in or to let him or her experience the conditions of team-building and team work, and it can therefore be an idea to put more emphasis on evaluating the group as such. In non-project organised education - and in all cases where the intention is to place the student in the centre of the situation - using individual examination and marking will underline the perception of group dynamics being regarded as tools for education.

> In short: Group evaluation and counting quality of deliveries does not influence the degree of project-organisation but it will not add to the problem-drive experienced by the student.

3.6 Other Variables

The time given for this Specific Project did not allow for going into significant detail on all other variables that influence the learning climate. Doing so would also imply that the WG should have the ability to distinguish between "good and bad" practice and be able to give concrete advice on how PBL should be performed in order to fulfil certain goals (which then also would have to be stated).

It is, however, quite clear that in problem-driven education, intrinsic variables, such as social motives, i.e. the teacher's ability to assist and control the students' development of learning competences, is of far greater importance than in traditional lecture-driven education.

Another important variable is the quality of the assignment (already mentioned in section 2). Again there is a difference between project and non-project organised education. Especially in the latter case where the assignment usually will be fairly detailed, its wording and "pedagogic logic" will have a heavy impact on the course of the work.

4. EVALUATION

Several functions can be placed under the heading "Evaluation": 1) Student evaluation, i.e. the students' possibility to comment on the method and content, 2) the student's evaluation of their own progress, 3) the lecturer's evaluation of the product, i.e. amount and character (quality) of presentation material and guidance, 4) the institution's evaluation of the course unit in question and 5) student examination. In the following, some remarks will be given to the first four items. The fifth is already mentioned in section 3.

4.1 Student evaluation

Since the use of PBL includes a certain amount of direct and often more individual student-lecturer contact, students will usually have good opportunities of commenting on the process and the way it is conducted. However, student evaluations that are more

formal should be included, at least once during the course – no later than halfway – and just before termination of the course unit. It would be prudent if some sort of written conclusion on the evaluation(s)
– including the course of exams – is *produced* by the lecturer in charge and *published*.

4.2 Students' evaluation of own progress

In situations with a high degree of assignment freedom (learning climates of the second and the third quadrant, see figure 3) it can be extremely difficult for the student to evaluate his or her learning progress, because there will be a tendency towards monitoring the progress in the project work more than focusing on the progress in learning. Furthermore, there is always the risk that division of labour will lead to an uneven distribution of obtained professional competence.

If, on the other hand the situation is highly lecturer-controlled, i.e. the forth quadrant, see figure 3, it is possible to "cut" the course unit into smaller manageable "packages". In this way, it is possible through prompt correction and return of the students' reports to give students continuous feedback on their progress. Furthermore, in this situation, group pressure will work on the sentiment of students. When working with discipline-inclined problems (often through very "heated" discussions) he or she will have a very strong awareness of their own learning status.

4.3 Lecturers' evaluation

The lecturer should realise that when PBL is performed, evaluation is a continuous process. Especially the first time(s) a certain presentation material (assignment plus other documents) is being used, a considerable amount of corrections and changes will be needed – the material must be corrected in accordance with the students' reaction and learning outcomes obtained. If the written part of the presentation material exists only in electronic form, continuous correction can be done quite easily.

4.4 The institution's evaluation

Quality management in educational organisations is already covered in great length by the working group B of EUCEET I. Therefore, in the following only a few items with special application to PBL will be covered.

In projects with high a degree of assignment freedom, it is always difficult to *document* professional content, meaning difficulties for the interested parties (the institution's "heads", employers, future students, parents, society, etc.) to judge this side of quality. Furthermore, if projects are not very well described in order to make it possible to hold them up against goals and politics stated by the institution, judging learning outcome and depth of learning can be difficult. One could argue that this is not new. In traditional education, it is also difficult to establish firm quality assurance. However, in project-organised education, especially with high emphasis on student control over the learning process, the situation could worsen.

As was the case with obtaining effective continuous feedback, it can be said that the lecturer-controlled situation offers better possibilities for effective quality assurance, especially if a high emphasis is put on developing learning competence. In this situation, it is *necessary* to implement quite detailed presentation material, which automatically will function as quality assurance.

As far as judging goal fulfilment, i.e. quality *control*, it is quite clear that effectiveness of this depends heavily on the amount and character of documentation (quality assurance). It goes without saying that without QA, no QC!

5. CONCLUDING REMARKS

The discussions in and the research done by the WG has made it quite clear that time and other resources available for Specific Project 5 of EUCEET II have not been sufficient for giving "square cut" recommendations, let alone giving manifest predictions of the effect on learning outcome and learning "quality" of such recommendations. However, it is the hope that the detailed description of the elements of PBL (section 2) and even more the suggested variables put forward and discussed in section 3 will contribute to the development of *much more* (than what is common at present) *operational* policies and strategies in this field.

For the WG's concluding views on the impact of variables on learning climate - here interpreted as degree of project organisation against degree of induced problem drive - please see section 3.

Furthermore, section 5 contains - alongside the analysis of examples of practice - the WG's view on how the listed and described examples can be mapped by means of the model developed in section 3. Please also refer to the conclusion given in section 5.3.

5.1 What could (should) be done?

Most of what can be read in this report is based on the personal experiences gained by those group members who actually use PBL under some form in their daily work - and on the discussion of this in the group. Although it is a fact that a "Google" search of the Internet using "pbl" as search word at present gives more than 680000 hits (the exact sentence "problem-based learning" gives 222000 hits), it is very difficult to extract valid research results on the effect of changing from a more traditional educational system to one containing elements of PBL.

Therefore, it is very important that large scale experimental research is done in this field. The main obstacle in measuring the effect of the use of PBL will be that the aim is (or should be) the development of a *competence* pattern and not only to "deliver" qualifications. It is still very important but by no means enough to measure the effect on depth of learning and degree of understanding. Consequently, the setting of goals must be more specific, more detailed for the single course unit and they should not only focus on professional competences. Research must relate the use of PBL to the fulfillment of these goals. Another difficulty is the problem of establishing valid control groups, because small scale experiments will give results different from a complete change of system.

It is the impression of the WG that the model developed in section 3 and the variables chosen can be used to explain the nature of PBL and to pinpoint the differences between different ways of applying PBL. However, the true study of the impact of PBL on the learning climate is one of motivation psychology. In the early stages of the work of the WG it was suggested (by Manfred Federau) that the dynamics of social motives, i.e. *n*-achievement, *n*-affiliation and *n*-power should be included in the analysis. More precisely: Can the research of people like Litwin and Stringer, published in "Motivation and Organizational Climate" (Litwin and Stringer 1968) be utilised in organising and developing group based engineering education? However, it was decided by the WG that this would lead too far. Still, it is the hope of the WG that the model developed in this paper can be utilised for future studies of the psychological drive induced by the use of PBL.

5.2 Can PBL solve the problem(s)?

As mentioned earlier in this paper the "efficiency" of using PBL in engineering education is only implicitly present in the mission of this project. However, it would be natural to mention the reflections of the WG on this issue.

What are the problems? Many things could be listed, the most important being:

1) "Overpacked" curricula (and syllabi for that matter),
2) "Understanding" versus "ability of application",
3) Motivation of students,
4) the problem of attracting more (and better) students to engineering courses.

The use of PBL type delivery will certainly have an impact on these problems. They are all related to the level of focus on learning competence. If a higher level can be reached, more "trivial" subjects can be taken out of the syllabus, subsidiary whole areas can be taken out of the curriculum. In other words: one should be more conscious about HOW you teach than WHAT is taught. The analysis in this paper shows that it is important to realise that delivery should move into the third and forth quadrant: project organisation ALONE will not do the trick.

In the same way the use of PBL will undoubtedly result in an improvement of motivation. The reason for this is that it is a key point that a certain piece of learning always will be seen as necessary for solving the problem or doing the assignment.

5.3 Teachers' personal competence

One drastic consequence is the change of role necessary for the educator(s) to fill the job. Many lecturers feel discomfort in losing the high degree of control over the situation, given from running the education from the podium in front of the class. In the case of project organised education, this problem can be enlarged if two or more educators work with the group and do not agree on how to act.

Another possibility of dysfunction is the question of how far the educator should go in assisting the group.

As already mentioned: The ability of "constructing" good assessment material play a very important role. Furthermore, there is a great difference between what is needed in quadrant two and three compared with quadrant four, see figure 3.

In project organised education, "the project itself" (the report, paper, drawings, etc. done by and filed by the student(s)) is part of what is evaluated. Also, the purpose of the education is to develop "project doing ability" in the students involved. It is therefore necessary that the purpose of the project can be seen explicitly from the assignment material: WHO is going to read/use it? WHAT is it going to be used for? It is seen that projects are accepted or graded highly because they are "good", even if they do not meet the "requirements". The reason for this is often badly constructed (or even missing, at least in writing) assignment material.

In the fourth quadrant, figure 3 the situation is completely different, mainly because the paperwork done by the student(s) (*only,* in an ideal world) should be seen as a means of communication and feedback. Here the assignment material will often be detailed and it takes great communication skill and long pedagogic experience to write assignments that will do the job: to force the student(s) to study, to read textbooks and to seek information and to communicate (orally and in writing) the result of their studying. If the assignment material looks like a cookery book, it will not do the trick. The good thing about assignment material suitable for the fourth quadrant is that it can be produced by colleagues working together on the same subject, it can be used (and reused) in many institutions. In short, it can be bought. It can be used as a means of cooperation between educational institutions. For this type of material much inspiration can be found in studying material made for distance learning.

5.4 Resources

The management of educational institutions will naturally ask the question: "will it take more resources (teaching manpower) to use PBL delivery compared to traditional delivery?"

This question is not easily answered, mainly because the two systems then should be compared on equal terms. Experience shows that, in the case of classes not larger than 40 students, the resources used (apart from resources used on development of assignment material) need not exceed that used for traditional delivery. On the other hand, in the case of cohorts of 150 students or more, it is clear that a direct comparison would come out against PBL. However, it is a question if the same quality can be reached, just like it is known that motivation triggered from traditional education can be low and that dropout rates are high.

Another factor that must not be forgotten, is the effect higher learning competences achieved in one course unit will have on resources needed to run later course units. At IOT experience shows that students who have passed the PBL-organised course unit in basic soil mechanics show considerable improved ability in "learning by themselves" in the following (elective) course unit in foundation. This latter could be run by using little amount of supervision, indicating that effects like this should be an important parameter in planning and executing future experiments as suggested in section 5.1 above.

Still, what can be learned is that PBL used on a larger scale within an institution could pay off, also in the sense of resources needed. Furthermore, course units run in "fourth quadrant mode" will probably serve the purpose of developing learning competence when used *from the beginning of the course*, thus easing the way of later course units, also as far as the need for resources is concerned. For the same reason, project organised education will probably be less effective (in terms of time and resources used and in gained quality fulfilment) when applied early in a course.

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Part 2: Report by *Marina Pantazidou*[3]

1. INTRODUCTION

The recent advances at the interface of instruction and cognition have given researchers confidence that it is possible now to design learning experiences to achieve targeted educational results (Simon, 1998). These advances provide the motivation to develop new instruction methods and re-evaluate existing ones. Meanwhile, educators have been aware for quite some time now of the different learning styles among university students (Kolb, 1984). Considering these insights from instructional psychology, it makes sense to combine an array of learning experiences, sometimes to capitalize on a dominant learning style, other times to strengthen a non-preferred one, in order to help students develop a variety of behaviors and skills.

This report aims at familiarizing civil engineering instructors with one category of learning experiences that most often appears under the name problem-based learning (PBL). Many other terms are also used for educational experiences in the spirit of problem-based learning. These PBL variants are derived by substituting "project" or "case" for "problem" and "instruction" or "education" for "learning". There is no agreement in the literature on a definition for PBL or on the distinguishing differences among its variants; there was no agreement among the members of the Special Project 5 Group either. So instead of attempting to provide any definitions, this report will focus on example applications of courses that are identified by their home institutions as PBL courses or courses having PBL elements. The examples follow after a brief background section, the aim of which is to broadly place PBL within the context of the various instructional approaches that can be used to achieve specific learning results.

2. BACKGROUND

2.1 The various instructional approaches (learning environments)

In the "Wall Street of words", learning is gaining value compared to instruction and teaching. However, on closer look, word values are hardly confusing. Even when instructors create a learning environment, they ultimately decide on an instructional or teaching approach. In every case, the decision of exactly how to run the course is theirs, including the latitude students have for decision making. Hence, it is better if one takes a neutral look at the various instructional approaches and evaluates them only on their suitability for achieving desired educational objectives.

The most time-honored instructional approach is based on lecturing. Lecturing can easily be supplemented with additional techniques, such as collaborative, problem-based or interactive learning. When these techniques form the backbone of the student-instructor or in-class exchanges, then we can speak of alternative instructional approaches. As an example, an instructor can devote part of lecturing time to collaborative learning activities, scheduling time for students to discuss and figure out in

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pairs answers to suitably concise questions. These activities can also become the mainstay of a course, if the instructor focuses on designing situations that facilitate peer learning. In such a case, we can speak of a clear break from a lecture-based course, where there can be significant interaction between the instructor and the students but typically very little among students. Similarly, problem-based activities can be weaved into the syllabus of a lecture-based course. Close to the other end of the spectrum, infrequent lectures can supplement a problem-based course. Section 3 of this report will discuss some civil engineering departments with sequences of several problem-based courses forming a PBL string and even entire curricula being organized around the PBL concept.

2.2 The various educational (or learning) objectives

One useful way to enable instructor and university accountability is to focus on clearly stated educational objectives. Some instructors still believe that educational objectives for a course are only related to the topic of instruction. But when the total sum of objectives is considered, i.e., over an entire curriculum, then it becomes clear that educational objectives must include not only topic-specific mastery, but also the development of general cognitive abilities. In recent decades, consideration of the performance of students after graduation contributed to further expansion of the list of objectives. So professional skills were added. These may include communication skills, management of projects, ability for teamwork, adaptability to various work environments. Finally, affective objectives, such as those related to developing confidence and self-esteem, are also being included in lists of educational goals. The considerable breadth of the spectrum of desired outcomes highlights the need to match selected educational objectives (or groups of them) with instructional methods.

Table 1 provides a template that can assist in articulating educational objectives at various scales (module, course, curriculum). When considering in parallel the varieties of educational goals and learning environments, it is clear that each learning process (e.g., students working on individual assignments) can be matched easier to some educational objectives (e.g., to learn to apply knowledge and skills) than others (e.g., to learn to collaborate with colleagues). And, to take the argument further, some instructional approaches can cover a wider-than-others spectrum of learning processes and educational objectives. Problem-based learning is such a method.

Table 1. Checklist of possible educational objectives and learning processes (adapted from Ertsen, 2000).

Educational Objectives

What are the intended educational functions of a project? course? curriculum?

Priority:	low				high
To raise motivation for learning	1	2	3	4	5
To learn new knowledge	1	2	3	4	5
To learn new skills	1	2	3	4	5
To learn to apply knowledge and skills	1	2	3	4	5
To learn to solve professional problems	1	2	3	4	5
To learn to collaborate with colleagues	1	2	3	4	5
To learn to communicate with other professionals	1	2	3	4	5

Learning process
Who is responsible for various activities?

Priority:	low					high
The teacher directs the learning activities	1	2	3	4	5	
Students work on individual assignments	1	2	3	4	5	
Students work together on group assignments	1	2	3	4	5	
Students select their own problem within a theme	1	2	3	4	5	
Students choose the members of the group	1	2	3	4	5	
Students decide on the individual contribution	1	2	3	4	5	

2.3 Problem-based learning (PBL): opportunities for Civil Engineering

For a better understanding of the opportunities afforded by PBL, this section will present some of its history and compare it with similar instructional approaches. Problem-based learning (PBL) first appears in the field of Medicine at McMaster University, Canada, in 1969 (McKeachie, 1999). Students are presented with a "problem", such as a patient with certain symptoms, and are asked to make a diagnosis. With PBL, there is a break from the traditional "forward" exposition of illnesses and their possible symptoms. Instead, PBL students have the opportunity to practice exactly what they will do in their professional lives. Hence, they can arrive from the symptoms in a "reverse" manner to the illnesses, also learning in the process the diagnostic value of a symptom.

The case method is an older, very much similar in spirit, instructional technique, developed in Harvard Law School in 1870, "reversing a long history of lecture and drill" (Garvin, 2003). The method aims at helping students practice calling on specific statutes to argue cases. Harvard's Business School adopted the case method in 1920 and its Medical School in 1985. The case method is also gaining popularity in Computer Language Programming (Clancy and Lynn, 1992) and Engineering Ethics (Gorman et al., 2000).

The specifics of problem-based and case-based methods may differ, but the overarching learning objective is common: students are called to draw from their reservoir of illnesses and statutes (the "theory") the ones pertaining to a specific case (the "problem"). It is the same underlying philosophy for assigning homework, with one important difference. In the case method and at least the PBL version in medicine, the problems are realistic and complete; in other words, no parts of the problem are separated for the student to first practice with something easier (e.g., solve a beam before solving a frame). The problem or the case is not a drill, but represents a bona fide professional situation; the problem may become less or more complicated to match the student's level, but it remains complete. This very attractive feature of the case-based methods creates the difficulty in finding suitably rich problems of manageable complexity; as a result, good, developed cases are offered at a price (Darden Graduate School of Business Administration; John F. Kennedy School of Government). The completeness of the problems makes feasible that, having worked on an appropriate variety of specifics (the cases), students can master through them the general (the theory).

Engineering shares with Law and Medicine an applied emphasis, hence it makes sense for Engineering to adapt some of their instructional methods, having duly considered both the similarities but also their differences. The existing structure of most civil engineering curricula, which include either dedicated design courses or courses with a significant project component, makes the transition to the case/problem-method easier. For the most effective application of such methods, however, some differences must also be stressed. The most fundamental difference is that Law and Medicine seem, to the non-expert at least, to be based less on a concise collection of laws of general validity and more on compilations of “best practices” (e.g., case law). It is feasible then that the less general-law-governed, less physics-like subjects of Engineering will be better candidates to profit from the available non-engineering instructional experiences with the case/problem-based methods.

Another practical difference is the difficulty in finding manageable but complete real-life problems in Engineering. This difficulty could only be remedied by encouraging engineering instructors to develop suitable problems (Cawley, 1991). Until then, it may not be feasible for engineering students to go from the specific to the general through problem-based education alone. As this report will present, the institutions or the instructors who adopted the PBL approach gave different solutions to this difficulty. Educational objectives specific to subject matter can be met both with project work and with lectures in a single course. Alternatively, courses can be sequenced so that students see the theory in lecture-based courses prior to or in parallel with the project-based courses. Finally, small (but not real-life anymore) problems can be created and assigned in such a sequence to guide the students to arrive on their own to the relevant theory.

The adaptations of the case-based methods have resulted in a wide range of PBL variants. Notwithstanding the aforementioned lack of consensus on defining PBL, there exist some typical elements in most PBL learning situations. These include the following characteristics (see also de Graaff and Kolmos, 2003):

- The problems are usually “real world” problems and, depending on areas and learning objectives, open-ended problems are often emphasized.
- Learning is student-centered; students are given more responsibility for their own learning.
- Learning is often organized in small student groups.
- Teacher’s activities are changing from lecturing towards facilitating and guiding.
- Active learning is promoted in a cooperative setting.
- Learning activities allow students to develop their unique learning preferences.
- Learning situations contribute to the development of life-long learning abilities.
- Formative feedback on performance is viewed as essential to facilitate learning ability and development.

With the above considerations in mind, regarding the varieties, the difficulties and the opportunities of PBL, we now turn to example applications of the PBL approach.

3. EXAMPLES OF PBL APPLICATIONS

3.1 Objectives

The aim of this section is to discuss with examples the feasibility of employing the problem-based learning (PBL) approach on different scales and to draw some conclusions from the variety of available options. The selected PBL examples are applications (i) at the university or at the curriculum level, (ii) in a sequence of courses forming a sizeable portion of the curriculum, (iii) in single courses, and (iv) in modules or parts of courses. This is not an overview, but a limited presentation; hence, it is necessary to mention the pool of available information. The pool consisted primarily of courses taught at the home institutions of the workgroup members; in addition, some sources from the published literature were reviewed. It is worthwhile noting here that, although the literature on PBL is voluminous, not to mention the proliferation of PBL-related web sites[4], applications in civil engineering do not abound. It was therefore a deliberate decision to limit the references of this chapter to civil and mechanical engineering applications only.

3.2 Descriptions of PBL applications

3.2.1 The PBL System at Aalborg University, Denmark

Aalborg University is a relatively young (30-year old) University, which was founded with the aims of being openly accountable for the education provided and of involving the students in the planning and content of education. This decision was a response to pressures born out from the societal changes in the 60's and 70's. At the same time with Aalborg's founding, the PBL approach was gaining prominence in the education community, and so the new university based its curriculum on an educational system that is problem-oriented and project-organized. In addition, for the last few years, the Australia-based UNESCO International Center for Engineering Education (UICEE) has operated a satellite center known as the UICEE Center on Problem-Based Learning (UCPBL) at Aalborg University.

As mentioned, the entire curriculum at Aalborg University is planned in the PBL spirit. Students are exposed continuously to the PBL principles from the first year onwards. In particular, a special curriculum is designed for the first year in the Faculty of Engineering and Science, known as the "basic year" (Moesby, 2002). The learning objectives include professionalism-related attributes and subject-matter competency in topics including both typical science requirements (mathematics) and basic engineering subjects (mechanics and statics). It should be clarified, however, that civil engineering students revisit these topics in later semesters. Learning in the basic year is structured around an introductory pilot project, followed by two bona fide projects of increasing size and technical content. Hansen and Sørensen (2003) provide several examples of such projects; one example project sequence is as follows: "The different roads in Denmark" (1st project – pilot, in 1st semester of the "basic year"), "Pure water in Aalborg" (2nd project, in 1st semester) and "Using energy from waves" (3rd project, in 2nd semester). Students work in teams and are supervised by a sizeable team of instructors. The significant investment in instructor time is an invariant for any PBL application, as will also be seen in the examples of the following sections. At Aalborg, significant economies of scale are achieved by not dividing the incoming science and engineering students into separate course programs. These "saved resources" are hence available for later years. It should be mentioned, however, that the Department of Civil Engineering is

[4] To cite a few: McMaster University, http://chemeng.mcmaster.ca/pbl/pbl.htm, RMIT University, Melbourne, Australia, http://www.dlsweb.rmit.edu.au/eng/beng0001/PBL-LIST/PBL/index.html, Stanford University, P5BL (Problem – Project – Product – Process – People – Based Learning), http://corporate.stanford.edu/research/programs/pbl.html

considering abandoning the basic year and instead taking over the instruction in the first year, in order to gain oversight of the entire civil engineering curriculum.

Hansen and Sørensen (2003) provide a detailed description of the civil engineering program, which starts from the second year of either the 3.5 year-course (for a bachelor's degree) or the 5-year course of studies (for a master's degree). The civil engineering program comprises a mix of courses that students successfully complete either on the basis of a graded final test (general courses) or through evaluation of project teamwork (project courses). The general courses can be categorized as mostly lecture-based, with emphasis on the subject matter (e.g., statistics, concrete technology, fluid mechanics, structural reliability). The project courses include not only several design courses but also a variety of the customary civil engineering courses (e.g., Soil Mechanics and Foundations – Advanced Soil Mechanics, Finite Elements, Construction Management, etc.). The two course categories are spread throughout all semesters, in such a sequence so that the courses with the emphasis on content provide the necessary technical background for the project-based courses. The specific combination of courses depends on the specialization students select among five engineering sub-disciplines, starting in their fifth semester.

The Danish Ministry of Education published in 2002 its most recent independent evaluation of the Faculty of Engineering at Aalborg University (Hansen and Sørensen, 2003). The results indicate that project-based instruction is particularly effective, the education provided is of great relevance to industry and the unemployment rate among the graduates is lower than 1%.

3.2.2 String of PBL courses at the Civil Engineering Program of the Norwegian University of Science and Technology (NTNU)

A string of four courses taught in a PBL format was introduced in 1997, at an opportune time for curriculum restructuring. The courses were introduced in the first two years (one in each of the first four semesters) of a five-year program. This change was part of broader restructuring that came about both as a result of societal pressures for increased accountability of universities (similar to Aalborg) and also in an effort to tighten the relationships with the industry, which contributed actively to this reform (Bratteland and Hjelseth, 2003).

The courses have broad objectives, focusing on the social aspects of learning as well as on subject matter. As part of continuous evaluation of the PBL string, NTNU is in the process of defining subject-matter learning objectives for each course. Students revisit technical topics in later years (similar to the technical topics of the courses in Aalborg's "basic year"), to various degrees, depending on their choice among the five offered civil engineering sub-disciplines. This limited specialization starts from the fifth semester, after all four PBL courses have been completed. In other words, there are no background differences among students enrolled in the PBL courses.

NTNU's PBL format consists mainly of placing a lot of emphasis on fostering an open learning environment and structuring learning activities around real civil engineering problems. Students are given a lot of responsibility as they work in teams and focus on what needs to be learned in order to do the work (i.e., offer alternative proposals for pre-defined projects). They are also given ample support, provided by trained "learning assistants" (these are senior undergraduates, roughly equivalent to the undergraduate teaching assistants in US universities), as well as by a significant teaching staff of four to five professors per course (more details are given below). One of these professors acts as a course coordinator. In addition, the course coordinators cooperate actively to ensure that the four PBL courses make a continuous sequence. Special emphasis is placed on (1) giving the students early a broad impression of Civil Engineering, (2) evaluating the students in a way that mirrors the PBL goals and format, as well as (3) assessing the effectiveness of the courses.

From the four courses, the first has a rather introductory role into Civil Engineering. In all four courses, the technical knowledge necessary for the completion of the projects is introduced in traditional lecture format. All courses place emphasis on development of team-building as well as on planning and implementation of the project work. Students are provided with course-specific reading material but are also required to seek additional information from recommended sources and on their own. Students work in groups of five. In the three first courses, professors assign students randomly in groups, while in the last course the students take initiative in selecting their team mates.

The course of the first semester, *Physical Planning and the Environment*, aims at introducing the students to sustainable urban development and to project work. An area close to the university is chosen, and students are guided through a two-stage process, including (1) situation analysis and (2) plan proposal, to offer solutions to concretely-phrased questions. The project is running throughout the semester. It is considered necessary to have well-circumscribed questions in this first course, since it is the students' first exposure to the PBL environment. The questions are clustered in three themes: land use and population, transport and the environment, water supply and wastewater management. It should be noted that although the questions in the analysis phase are posed by the instructors, they are reasonably open, providing the students with the opportunity to go "along different roads". The planning phase, where the students shall find solutions to problems defined in the analysis phase, is fairly open. The course also includes introduction to and use of GIS as an important project tool. The grade is based on project work. Grades are assigned to teams, but differentiation is also possible. Four professors teach this course, with one of them acting as coordinator.

The remaining three courses are grounded in specific areas within Civil Engineering: Environmental Engineering (2^{nd} semester), Building Materials (3^{rd} semester) and Design of Buildings and Infrastructure (4^{th} semester). Each has specific technical contents in its description. The courses follow a similar PBL-inspired format (i.e., a combination of lectures, where the course content is introduced, group work, counseling time and activities outside the class, e.g., site visits) with small variations.

In *Environmental Engineering*, the content of the course varies depending on the needs of the project assignments. Students work on smaller tasks (somewhere between a project and an assignment) and grading is based by 70% on the assignments and by 30% on individual tests. Two professors coordinate this course, which is taught by three more professors, each covering water quality and treatment, waste management and the built environment.

In *Building Materials*, students are introduced to the relationship between structure and the material properties, for three categories of materials: concrete, metals (steel and aluminum) and wood. Students work on three projects, one for each material category. As in Environmental Engineering, the grading is based by 70% on the assignments and by 30% on individual tests. In addition, there are three mandatory laboratory exercises and one oral project presentation, and the students get some credit for these activities.

One professor coordinates this course, while three more professors provide material-specific expertise.

The *Design of Buildings and Infrastructure* emphasizes design principles and the production of engineering drawings. Not only is the subject matter necessary for the projects formally introduced, but training for the use of CAD software is provided as well. Traditional – but optional – assignments are provided for practice of the introduced technical material. The grade is based on the performance on two projects. This course has four professors-coordinators, each covering separate design issues (building design, structural design, water and sewage, road design).

From the description above, it becomes apparent that this string of courses requires a continuing resource investment from NTNU, intensive coordination among many professors covering the various civil engineering sub-disciplines, as well as close collaboration with the industry in order to ensure a constant flow of project topics that are both real-life and appropriate to the students' level.

Background considerations for the PBL courses at NTNU

NTNU acknowledges that PBL encompasses a variety of concepts and approaches, varying from field to field, from university to university and from teacher to teacher. PBL is considered a process and a tool with considerable flexibility, which can take many forms – in other words, it is not considered an educational product as such. PBL can be used for various levels as a framework for modules, courses, programs and even entire curricula. It can be viewed as a pedagogical strategy where the problem chosen is the main driving force for learning. This concept can be used for case studies, basic or applied subjects, projects and even research.

Engineering education does not traditionally value process skills as outcome of educational programs. For PBL this poses a challenge, as process and teamwork skills are important aspects. What is more, process skills are not easily "visible" and readily measurable. This could in turn influence student attention and focus, as the students tend to learn what is tested and measured and study to achieve successful results.

A flexible PBL concept will meet and respond to global developments and trends in learning, as extensively discussed in E4 Thematic Network[5], and in the Tuning Network[6]. These trends address changing demands from employers as well as relate to increased focus on internationalization. They clearly include a shift of focus from teaching to learning-centered approaches, and a move towards more explicit competence and outcome orientation. The respective courses should be put into a more holistic and comprehensive view of the curriculum developments, and an appropriate and effective use of modern tools and technology should be included. As already mentioned, students do have different learning styles, and the learning environment should be able to address these in a flexible way. Development of active and reflective learners is considered to be imperative for fostering and supporting life-long learning abilities.

Student perspective

In the various forms of PBL, the role of the student is different compared to an educational situation where focus is on lecturing, often combined in civil engineering

[5] E4 Thematic Network: Enhancing Engineering Education in Europe, http://www.unifi.it/tne4/

[6] Tuning Educational Structures in Europe. Final Report, Pilot Project – Phase 1, 2003, http://www.unideusto.org/tuning/

with well-defined exercises, specifically illustrating the subjects covered in the lectures. Students develop competences through a broad range of interacting elements in an open learning environment. Thus student perception, assessment and judgment of this learning environment are critical factors for the final learning outcome. Some of the ways students benefit from a PBL setting are as follows:

- Development of responsibility for own learning and for becoming an active learner.
- Engagement in a relevant work form for a civil engineer.
- Emphasis on linking theory and practice through projects and cases.
- Improvement of linkages between “industry” and society and better understanding of their interaction.

Work in a PBL environment helps students with:

- understanding, experience and competence in teamwork.
- involvement, motivation and innovation.
- defining problems and viewing these problems in a broader perspective.
- developing their curiosity, creativity and critical thinking.

Relative to the societal needs and the future role of the civil engineer in this context, these issues are considered important to develop and nurture during the studies. In line with responsibility for own learning, there must be clearly defined consequences if this responsibility is not taken, and the students must experience that they are taken seriously.

Most students develop large interest and involvement in PBL activities, as demonstrated by their willingness to spend time on the subjects. This being the case, it is up to the organization and the teacher(s) to provide the learning materials and the environment that will secure the wanted outcome of the learning. Student involvement is an asset, and definitely not a problem.

Assessment of student work

Evaluation is an extremely important part of the learning process, and should be addressed as such (Bratteland and Hjelseth, 2004). Hence, the assessment of student work outcome is an important integral part of any PBL activity and must be clearly linked to the defined learning objectives. To facilitate learning, feedback to students is needed in a form that will aid the students in making desired changes during the learning process. In this context, formative evaluation (evaluation during the course) is considered to be a viable approach. This can be done formally by written comments on draft reports, or as informal feedback during discussion with students. Formative assessment can also be used for skills and attitudes. This is an extremely important additional element for creating motivation. Use of formative evaluation gives the teacher feedback for further learning and guiding of the students.

A key question on assessment is whether the grading should be based on group reports only (common group grade), or it should be based on some kind of individual tests as well. The first approach is definitely challenging in providing the necessary incentives and responsibilities among students to acknowledge and focus on the wanted activities and actions. Mixed approaches, with a certain percentage weight on the common group reports and the remaining weight on individual test results, can also be used.

The summative evaluation (evaluation for the final grade) should reflect individual variation of the students’ work and learning process. Portfolio assessment can be a good method for handling multiple pieces of student work. The elements in the portfolio can consist of common project reports (one or more), oral presentations, posters/models, laboratory reports, field reports, reports of reflection (own learning process and collaboration) and individual test results (one or more). The final grade can be based on summarizing results multiplied with the weights of each element in the portfolio.

Regardless of the specific approach, assessment and feedback should be transparent, with clearly defined criteria, aiming at giving guidance and reflection on own learning development and abilities. Feedback should be given on issues that students should focus on, including both professional learning and development of other skills, such as teamwork and collaborative ability. Still, it is important to keep up the responsibility of the students for making adequate use of the assessments in their continued work.

Lessons learned

Students are by and large responding favorably to the PBL approach introduced at NTNU. Within a stated and transparent overall framework, defining common basic criteria and characteristics, diversity and flexibility should be allowed in layout, design and running of the courses.

Motivation among students enrolled in the PBL courses is high as demonstrated by the time students spend on these courses – which is close to, and sometimes above, the set time norm. Use of time must be followed up, and time norms should be adhered to.

Learning responsibility is clearly moved from the teacher to the students. Teachers are acting primarily as facilitators. Hence, well-defined and understandable learning objectives become extremely important. Negligence by the students to take this responsibility should result in clear and transparent consequences. For the development of inter-personal relationships and teamwork skills, use of trained learning assistants has proven to be very useful in the facilitation process. Introducing a “one day per subject” concept has provided significant benefits in more effective work and facilitating a better learning environment.

To secure an integrated and well-designed approach by potential external resource persons, it is important that these are included as active members in the teaching team. If this requirement is met, use of real, ongoing cases – especially those that offer opportunities for excursions and surveys – provides considerable added value. The PBL concept generally calls for stronger cooperation and coordination between teachers involved in the course. This provides opportunity for putting the work into a broader context and reducing the amount of unwanted and unnecessary overlapping.

3.2.3 String of design courses in the Faculty of Civil Engineering and Geosciences at Delft University of Technology, the Netherlands

Within Civil Engineering at Delft, two sections, those of Design & Construction Management and Project Education, used to offer design-related projects. In recent years the two sections decided to collaborate and now offer one design project in each of the three years of the Bachelor’s program. The overarching objectives for the three courses are: familiarity with the cyclical design process (1st year), ability to progress from broad concepts to detailed design (2nd year) and controlling the interfaces that require interdisciplinary coordination (3rd year). The specific learning objectives include effective teamwork and group learning, as well as performance at professional level (this is ensured by having representatives from the industry acting as clients for the design products). It should also be noted that the prominence of the technical content in the list of the learning objectives increases each year. The first year’s project, which started being taught earlier than the others, has already been evaluated and received very positive feedback from students (de Ridder et al., 2003).

3.2.4 Problem-based, discipline-oriented education at Civil and Building Engineering, Odense University College of Engineering, Denmark: an application in Soil Mechanics

Beginning February 2003, the Odense University College of Engineering (IOT) started changing its first three (of seven) semesters in its 3.5-year course from more traditional lecture-based education to problem-based, project-organised learning. Each of these semesters will in the future contain one large project covering no less than 60% of the ECTS points offered. In the future, all specialization and all elective course units will be placed in the 4th and 5th semesters, the 6th will be used for an obligatory internship and the 7th for the diploma project. The transition was planned to be completed by the end of the autumn semester 2004. The first courses that changed the delivery method were Soil Mechanics (Federau, 2002), Construction Management and to some extent Solid Mechanics. All three are required courses. They are taught in the fourth of the seven semesters and they correspond to six ECTS points.

Soil Mechanics, as taught in IOT, is an example of maximum emphasis on creating an environment that fosters independent learning. The students work in groups of three to five members on eight assignments covering all the basic areas of Soil Mechanics: seepage, deformation, strength of soil, soil stability and earth pressures. When the course begins, the students have no prior knowledge in Soil Mechanics. No lectures are given and only very little (non-technical) introduction is given to the course content and to each assignment. The students have access to guidance from the instructor during five 45-minute periods per week. Class size can vary; the maximum has been approximately 40 students, meaning that guidance time amounts to 6 - 10 minutes per student per week.

Problems are assignment-like and questions are formulated in steps to facilitate completion of the assignments. The students must take the initiative to learn on their own the technical content required for the problems, which are corrected and returned to them together with a substantial amount of oral comments. The quality of the deliveries (i.e., correctness of the solution) has no impact on the final marking of the individual students – the main idea is to put the students in the center and to emphasize their responsibility for their own learning. The students are evaluated by means of an oral examination at the end of the semester.

As far as the PBL format is concerned, the students have rated the course fairly highly. The main complaint concerns the workload needed, although it is doubtful that the stipulated 30 hours of workload per ECTS point represent the typical student workload. It has been noted, though, that professors in courses taught during the same semester complain about the attention the students give to the PBL-organized courses (two courses and part of a third one, out of a total of five).

Partly to introduce the more general remarks in the concluding Section 4, it is worthwhile to stress here the differences between this Soil Mechanics course and the project courses presented earlier. The Soil Mechanics course is a required core course in civil engineering curricula and, hence, it has to introduce some basic concepts as well as to provide opportunities for the students to familiarize themselves with these concepts in the most characteristic geotechnical applications. In contrast, design and project-based courses have significant latitude in the selection of topic-specific learning objectives.

3.2.5 A vibrations course in PBL format from the Mechanical Engineering Department of Imperial College, UK

In this case the instructor redesigned a traditional lecture-based course in vibrations into a PBL format (Cawley, 1991). The course was a final-year elective course in an honors mechanical engineering three-year degree program. The motivation was the students' avoidance of exam questions that required diagnostic (or forensic) skills; in other words, the students avoided backward-stated problems of the type "why did this component fail?" or "why this system did not behave as was anticipated during design?" Since the course was to be redesigned, the objectives of the original course were expanded to also include development of professional skills. However, it should be stressed here that the instructor explicitly wanted to avoid an increase in the students' time due to the new course format.

The new course was designed around three pairs of problems; the selection of problems was a major factor in the success of the course (Cawley, 1991). They had to be real-life and, at the same time, manageable. Cawley (1991) provides one such example. The redesign of a pump leads to fatigue failures of one pump component; students are asked to sort out why failures are occurring and to propose a solution.

The students worked in groups of four. The groups were also paired; each paired group received a pair of problems, problem A and problem B. For problem A, one group would act as consultants (doing more detailed work), while the other group acted as the client group (checking the consultants' work). For problem B, the paired groups reversed roles. Each problem occupied six to seven weeks and ended in an oral presentation. With two instructors and a maximum of 12 groups, the presentations did not require more than three one-hour sessions for each pair of problems.

In terms of "traditional teaching", the course included four scheduled lectures and demonstrations. The students were given lecture notes and references of 20 relevant textbooks. No new course material was written for the PBL version of the course. Apart from the problem presentations, the programmed contact hours of students with the instructors included one tutorial of 20 minutes for the first two pairs of problems; there was no formal tutorial for the third pair, in order to underscore the increased autonomy of the students as they matured throughout the semester. However, the students could consult the instructors during regular timetabled periods. With the new format of course delivery, the assessment also changed: reports and presentations amounted to 66% of the final grade (problem grades were assigned according to problem difficulty, which increased from the first pair of problems to the third); a written test of concept understanding counted for 30%; and the written solution of a problem contributed the remaining 4%. The individual exams (the test of understanding and the problem solution) were added after the first year the course was taught, in order to increase the grade spread and also at the students' suggestion, who felt that the team grade was unfair for the members who worked much more than others. A detailed student questionnaire indicated that the students clearly enjoyed the course, a finding reinforced by the upward trend in course enrolment. The PBL model was clearly successful and, as a result, was adopted in other courses at the same institution.

The information presented thus far was obtained from Cawley (1991), an article written by the professor who had taught the course for three years. This professor was also contacted in January 2004 and provided additional information. He ended up teaching the course for about six years. In 1993-4, the course changed instructors but kept the same format until an overall revision of the degree courses cut the allocated hours and imposed limits on coursework content. In addition, budget (funds allocated per student) was reduced by about 30% in the mid 90s; this made it very difficult to justify using PBL, since, in such a course the staff load rises in proportion to the number of students. There are no longer any courses running on this model, though some do still incorporate elements of PBL ideas.

This is an excellent example of a mainstream, traditional mechanical engineering course being taught in a PBL format. There are however two aspects of this particular application which hamper its straightforward adoption by any instructor at any institution. First, the fact that all the students belonged in an honours program guaranteed that the students were above average, which typically entails increased autonomy and ability for independent work. Hence, although the institution did not have a PBL culture, it must have made it easier for the students to not just cope with but to actually like the course. Second, the links of the instructor and his colleagues with the industry was highlighted as a key factor for identifying suitable problems; indeed, the instructor made it clear that the time required for locating suitable new problems was an issue. Therefore, after collecting new problems for three years, the instructor used variants of them in cycles during subsequent years (Cawley, 2004).

In summary, this vibrations course is structured around open-ended, real-life problems, while minimal guidance with regards to the required technical content is given to the students. This is made possible by the careful selection of the problems that enable the students to take initiative in seeking the required technical background, while at the same time allowing the instructor to fulfill the technical learning objectives of a required core course in mechanical engineering. Besides, the list of textbooks ensures that students are informed about good (comprehensive) references where they can find answers to problems not tackled during the course. In this way, even missed technical objectives can in some sense be addressed.

3.2.6 IT-supported PBL course of Structural Engineering at the University of Ljubljana, Slovenia

A new structural engineering course has been introduced in the five-year program at the University of Ljubljana, targeting both architecture and civil engineering students. The students work in groups of two (one student from each discipline) and are required to define a problem (design some structure) and to analyse it. The architect is expected to provide a first design, which is then negotiated within the group, until a final design satisfactory to both the architect and the engineer is agreed upon. It should be noted that the instructor often has to intervene at the negotiation stage in order to ensure that a design appropriate for the students' level is selected. The students work on the detailed analysis of the structure independently, each from their discipline's perspective, while being in close contact mostly through the Internet (this is not necessary, but the course is structured so that students become familiar with internet-facilitated work habits). Since the students are free to select their project, it is obvious that the course cannot have pre-determined subject-matter learning objectives. The students have prior courses in Structures; any additional required technical material is covered by the instructors on an as-needed basis, or obtained by the students from the literature or the Internet. This PBL course, like all PBL courses, requires significant time investment from the instructor: for

10 pairs of students, two instructors are fully engaged eight hours a week, often soliciting expertise from other colleagues, depending on the project selected by the students.

3.2.7 A PBL module in a Geotechnical Engineering Course, at the Port Elizabeth Technikon, South Africa

This module was developed as part of Geotechnical Engineering, a core second-year course in a three-year civil engineering degree programme (Mgangira, 2003). The module is scheduled in week 7 of a 13 study-week course, after the students have developed familiarity with soil testing. The instructor gives the student groups a task brief, describing the problem boundaries (i.e., the need for interpretation is deliberately built in), outlining its objectives and the professional skills intended to be developed. The task is related to compacting a soil-cement mixture, in order to make bricks using the hand-held compactors typically used by the local community. Each group deals with a different mixture. The task builds on students' prior knowledge of soil compaction from the lectures, but also extends beyond a typical class exercise to include: (1) the realistic element of a potential community-based project, (2) team work, (3) the possibility to form partnerships between groups as they discover the implications of the different consistencies each group works with, and (4) report-writing plus an oral presentation on the final product. Student responses to questionnaires showed that more than 75% of the students felt that the project helped them develop skills in communication, teamwork and problem solving. Open-ended questions, however, revealed that some students felt the task was too time-consuming and that, at the beginning, it was difficult to understand what was expected of them, having no prior experience with a similar task.

This module is mostly focussed on the development of professional skills of the students, i.e., on the social aspects of learning, such as communication and teamwork, brought forward by PBL exercises. The module places minimal emphasis on motivating subject-matter learning through the problem handed to the students, i.e., on the cognitive aspects of PBL. The scope the module is limited, although suitable for its size. The module makes use of few theoretical PBL principles (employing real-life problems, fostering group-based learning and, to a smaller extent, activity-based learning). Nevertheless, it was selected as an example in order to demonstrate how non-traditional instruction approaches can be grafted in traditionally taught courses without requiring prohibitively large time investment. Besides, such a modification being made, it is an easy next step to reverse the order of the course activities, in which case the project can drive the study of compaction, instead of serving as an opportunity to apply existing knowledge.

4. CONCLUSIONS

By reviewing the presented variety of PBL applications, several conclusions can be drawn with regards to the PBL format employed and the scale of the PBL application. Most of the PBL-type courses are project-based, which is expected, since project-based practice of theory has been a long tradition in Engineering Education. Project-based courses are the natural candidates to include PBL elements, by incorporating some of the widely-accepted PBL characteristics, such as employing real-life problems, motivating a participant-directed learning process, and facilitating experience learning, activity-based learning, interdisciplinary learning and group-based learning (de Graaff and Kolmos, 2003).

The most difficult PBL candidates seem to be the courses that have a very specific list of technical subject-matter learning objectives. This is because open-ended projects may include some of the fundamental concepts and applications of a technical course but are unlikely to cover comprehensively a list of subject-matter learning objectives. The course descriptions in Section 3 offer two possible solutions to the problem of recasting a traditional lecture-based technical engineering course in a PBL format. The instructor of Soil Mechanics (Section 3.2.4) chose to focus on facilitating participant-directed learning process, and on fostering group-based learning from the aforementioned main features of PBL education (de Graaff and Kolmos, 2003). These goals were achieved by eliminating lectures and organizing the students in groups. In order to fulfill the technical learning objectives, the instructor used typical textbook-type questions broken-down in steps to make it easier for the students to locate in textbooks the required technical content which they then have to learn, mostly on their own, in order to complete the assignments. It should be stressed here that there is nothing inherent in PBL that precludes lecturing as part of the learning process, nor is absence of lectures preferable under all circumstances. On the contrary, research has shown that a combination of independent learning *followed* by lecturing can give better results than lecturing alone or participant-directed learning alone (Schwartz and Bransford, 1998). The instructor of Vibrations (Section 3.2.5) chose an alternate approach: he devoted a lot of energy to locating real-life problems that offered the opportunities needed to fulfill the technical objectives of the course and were, at the same time, suitable for the students' level. It is worth reiterating here that the instructor of Vibrations stressed that the time required to locate such problems was an issue.

Considering the dearth of real-life yet manageable engineering problems, it is possible to conclude that Engineering lends itself less to a PBL approach compared to disciplines where such problems are more common and diagnostic skills are more in demand, such as Medicine. There is another, more optimistic, possible conclusion that follows from the limited experiences presented herein [see also the problem of springs failing after paint-removal with heat treatment given by Perrenet et al. (2000)]: if instructors move their attention from design problems to diagnostic (or forensic) problems, the engineering education community may have available more problems suitable for PBL education.

Finally, it is important to stress the different challenges across scales. Changes at the university/department level require a very significant investment. It is not surprising then that relatively few institutions or engineering departments have implemented large-scale applications of PBL. To this workgroup's knowledge, apart from Aalborg and NTNU, these include the Engineering School at Universidad de Castilla La Mancha, Spain (Menéndez, 2003), the Mechanical Engineering Department at Delft, the Netherlands (de Graaff and Kolmos, 2003), and the Mechanical Engineering and Biomedical Engineering Departments at Eindhoven, the Netherlands (Perrenet et al., 2000). For most of the institutions mentioned above, experience shows that PBL applications are implemented at critical junctures of the department's or the institution's history. However, once implemented, they create a "PBL culture" that helps students acclimatize to the different educational style. On the contrary, more isolated or independent initiatives continuously operate in a contrarian mode. It is conceivable that this dissonance in teaching and learning styles between a PBL course and the remaining traditional courses may not only increase the effort required from the instructor to keep up the PBL course but also decrease the potential benefit for the students.

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Report of the **Working Group** for the Specific Project 6

Use of ITC in civil engineering education

ICT IN CIVIL ENGINEERING EDUCATION

Kees van Kuijen[1], Jan Bunjak[2], Ralf Reinecke[3]

1. INTRODUCTION

Within the thematic network activity in the areas of learning for innovating and attractiveness of learning environment in education and training of civil engineering, EUCEET II has developed a special project focussing on the application of ICT in education. IT has and will cause great changes that affect all organizations, work content, business, physical and virtual products, and tools in all aspects of modern society. The introduction of modern information and communication tools can help generating an enhanced and flexible learning environment. Further more within civil engineering education it is of great importance to be aware of what changes are relevant for the building sector. In adapting to the ongoing process it is possible to outsource specific competencies, but also form strategic coalitions in new interdisciplinary ways. In today's and even more in the future building industry, it will be necessary for civil engineering graduates to take actively part in managing, design, implementation and evaluation of tomorrows building process support systems. This paper presents the situation of ICT in the European civil engineering education based on members input of the EUCEET thematic network and explains by key points the target and prospect of its present and future application. The report is concluded by giving samples of good practice linked to the developed key points. Special requirements for applications are listed in order to successfully establish ICT in education. It is obvious that students need to have sufficient expertise in technology, be an active learner and able to solve problems occurring within the application and fulfil the system requirements in hard- and software. The same necessities apply for the institution as well as the teachers. In addition to this there is a strong demand for educational design to enhance the attractiveness of the application and for realising that the costs of development function as an investment for the future. It is obvious that innovations within ICT are sharpening global competition which will soon also affect the educational sector.

Looking at Information and Communication Technology (ICT) we have to realise that since the Bibliotheca Alexandria the spoken word and the text written on a piece of paper were basically the only ways to transfer information from one person to another. This form of communication did not change for about 2,300 years. But with the invention of the radio and the cinema in the end of the 19^{th} century for the first time, information could be transferred not only crossing greater distance but also reaching an audience which number was only limited by their possession of a receiver. In the middle of the 20^{th} century the first computers were built and television started to establish itself

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as the major source of information. 1990 the internet started to become popular with the invention of the first multimedia capable browser, the so called: *NSCA Mosaic*.

With an increasing pace, innovations significantly changed the way how communication and information transfer worked over the past 30 years. Still the developments when looking at education and training are little and the format of knowledge transfer officially remained the same as 250 years ago when the first university for engineering was founded.

Table 1. Members of EUCEET II special project 6

Representative	Institution / Country
Vladimir I. Andreev	Moscow State University of Civil Engineering, RU
Carsten Ahrens	Fachhochschule Oldenburg, DE
Wojchech Baranski	University of Lodz, PL
Dion Buhagiar	University of Malta, MT
François-Gerard Baron	CNISF, FR
Eivind Bratteland	NTU Trondheim, NO
Jan Bujnak	University of Zilina, SK
Alberto Corigliano	Politecnico di Milano, IT
Aniko Csebfalvi	University of Pecs, HU
György Farkas	Budapest University of Technology and Economics, HU
Matej Fischinger	University of Ljubljana, SI
Kees van Kuijen	Delft University of Technology, NL
Ertsen Maurits	Delft University of Technology, NL
Ian May	Heriot-Watt University, UK
Marina Pantazidou	National Technical University Athens, GR
Raulica Raileanu	Technical University "Gh. Asachi" Iasi, RO
Xavier Sanches-Vila	U.P. Catalunya, ES
Dan Stematiu	Technical University of Civil Engineering Bucharest, RO
Carsten Sorensen	Aalborg University, DK
Jean-François Thimus	Université Catholique de Louvain, BE
Helena Wasmus	Delft University of Technology, NL
Ralf Reinecke	Technische Universität München / IBR, München, DE

Within the Thematic Network of EUCEET (European Civil Engineering Education and Training) a special project evolved from the theme "Development of the teaching environment in civil engineering education" [1] concentrating on the use of ICT in civil engineering education. During this special project, teachers together with ICT experts discussed the present situation of E-Learning throughout Europe and the needs and possibilities to find an optimum in incorporating ICT in education.

2. THE APPLICATION OF ICT REFLECTED BY EUCEET

To obtain an insight on the different degrees of ICT applications throughout European institutes for civil engineering education an internet based questionnaire [2] was distributed among the 126 EUCEET II members from 28 countries. 38 answers from 18 different countries were received and evaluated. Since the respondents were in almost all cases teachers or researchers in the area of civil engineering it is obvious that the submitted answers resemble individual viewpoints and certainly do not allow conclusions about the ICT application at their institutes in general. However the results still provide a flashlight on the use of ICT among members of the EUCEET thematic network.

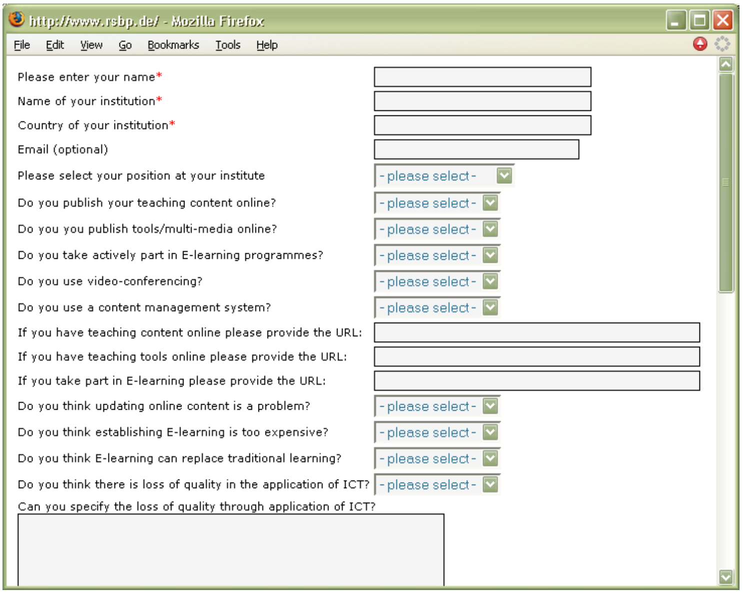


Figure 1. Screenshot of the EUCEET II SP6 On-line Questionnaire

Figure 2 illustrates the activity of the responding members distinguishing from their major occupation as teacher, researcher or administrative. Among the answering members 42% have content and/or tools published online on the internet but only 23% do actively take part in e-learning projects. 32% use advanced communication tools like video-conferencing and only 27% are taking advantage of publishing their online content via a content management system (CMS). This means that half of the teachers who make their educational material available on the internet are dependent on their own expertise and resources in html-programming.

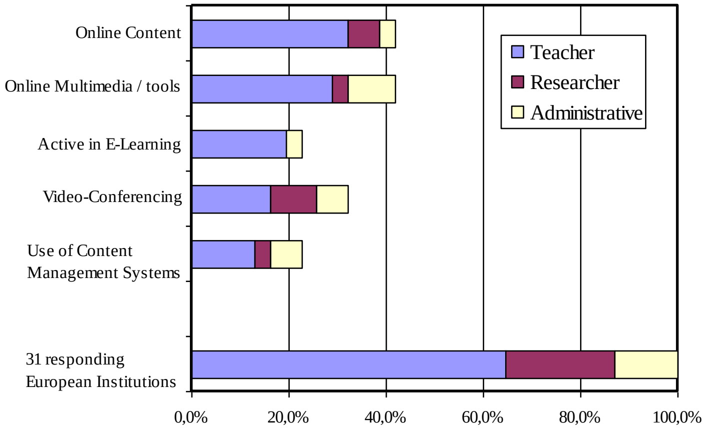


Figure 2. Application of ICT in Civil Engineering Education – Answers to the EUCEET II SP6 Online Questionnaire.

The educative quality of the submitted online content varies widely. The URLs provided as samples did range from a simple display of the study programme to multimedia textbooks with highly interactive tools. In addition to the little number of teachers actively applying ICT in their courses, these striking differences illustrate that in many cases the existence of online content is based on the work of enthusiastic individuals.

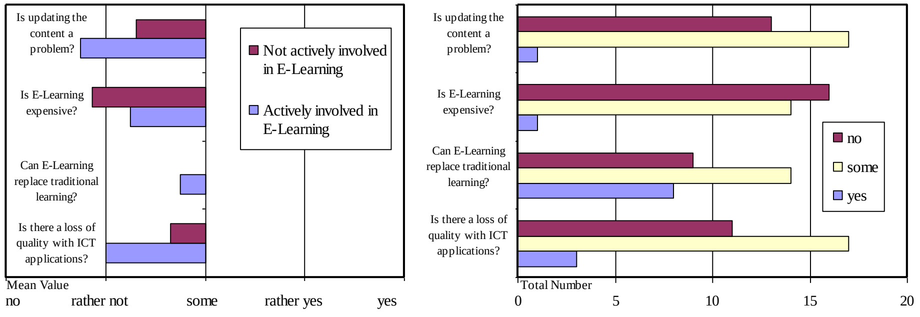


Figure 3. Personal opinions on the impact of ICT applications – answers to the EUCEET II SP.6 online questionnaire

Asked on possible problems and difficulties when applying ICT in teaching, most of the answers were rather optimistic. Updating the online content is not seen as a serious problem although the majority of 55% felt that sometimes it might be a constraining item. Since time and money often are referred to as the most important reasons to reject involvement in e-learning, the fact that most respondents (52%) thought that establishing e-learning would not be expensive was rather surprising. The question if e-learning would be able to replace traditional learning turned out to be quite controversial with almost equal opposing results (29% “no” and 26% “yes”). The specific loss of quality stated by most of the people was the loss of personal contact either with the teacher and the fellow students.

In order to mind the different levels of personal experience of ICT applications in education the left diagram in figure 3 displays the opinions on ICT dependent on the respondents’ activity in e-learning projects. While teachers with e-learning experience tend to see not much loss in quality and also no problems in updating the online content, their impression on the financial aspect is more sceptical than of teachers which are not involved in e-learning activities.

These results underline the assumption that teachers who experienced for example a content management system (see later in Tools for e-learning) realise that modifying or adding educational material online without being a programming expert is basically a technical problem which already has been solved. Also having experienced the possibilities of ICT applications, the loss of quality is viewed less critical. On the other hand e-learning costs are considered higher than by people who have not been involved in e-learning.

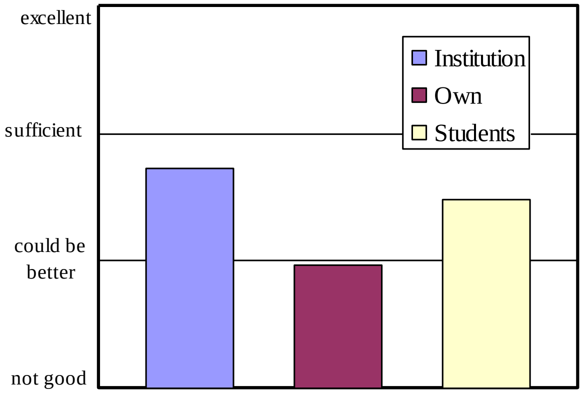


Figure 4. Personal opinions on the expertise on ICT – answers to the EUCEET II SP6 online questionnaire

Asked to judge upon the ICT support at their university and the students and their own expertise in ICT, 80% felt that the ICT support at their institute was either sufficient or that it could be slightly better. 49% had the opinion that their own experience could be better, while the students' expertise was viewed superior at 52% voting for sufficient expertise.

The gap between the students and teachers expertise might be explained by the difference in age. Due to the acceleration of innovations in new technologies, this gap will probably increase. Clearly the ICT support at the university needs to keep up with new technologies in order to bridge this gap and to ensure a form of education which responds to the students of modern society.

3. TOOLS FOR E-LEARNING

When talking about to the use of ICT in education in this paper it is only referring to teaching & learning supported by electronic information and communication technologies, usually referred to as e-learning. While e-learning is often understood as internet or intranet based learning, there is a full range of tools and options available within electronic supported technologies that contribute to civil engineering education and training.

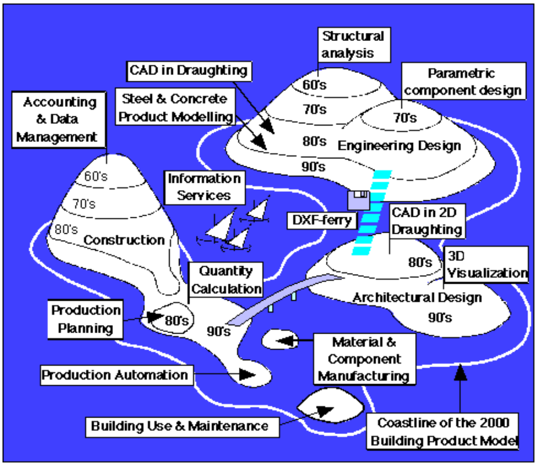


Figure 5. Islands of automation within the building process (after Matti Hannus and Pär Sill'en, VTT, FINLAND) [3].

Web based Communication

The increasing speed and capacity of broadband internet connections and UMTS resemble a new generation of advanced communication tools enabling video, speech or document real-time exchange between two or more people through a network.

- **Email**: The electronic mail system is used to compose, send, and receive messages utilising electronic communication systems which may contain all sorts of digital data. Due to free web based email account providers email at present resembles the most common form of internet based communication.
- **Online Forum**: Online forums are web based applications and derived from newsgroups to enable the exchange of ideas and messages. Forums are often used by online communities in order to discuss topics in public or among selected users.
- **Instant Messaging**: The major difference between email and instant messaging is the fact that conversations hosted by instant messaging services take place in real time. Since the necessary client needs to log on to the service, most systems offer a buddy- or friends list to indicate whether personal contacts are currently available for chat. Recently, many instant messaging services started integrating video-conferencing features, Voice Over IP (VoIP), and web conferencing services. Common services for instant messaging are the Internet Relay Chat (IRC), ICQ, NET-, Yahoo!-, AOL- and MSN Messenger.
- **Chatrooms: A chatroom is an online forum offering the possibility to broadcas**t message exchange online in real time. Chatroom sessions can be moderated and structured depending on different administrative user rights. Modern chat systems also allow the application of games and educational material (e.g. java scripted chats) or even facilitate audio and video communications.
- **Webcasting**: In general webcasting describes the internet based transmission of television programs. Users may log on to a webcast client, which is distributing and displaying the (in most cases live) televisual content. Since the telecommunication

based video-conferencing was bound to high costs and special technical equipment, recently webcasting is used to record video conferences and training material.

Data base

A database is a collection of facts, or pieces of knowledge which can be managed, evaluated and searched using a database management system (DBMS). Data can be structured in various ways, which are referred to as data models. The increasing access to different data bases and their connection and organisation through networks is an important factor for the use ICT to support education in order to take advantage of these resources.

- **Search Engines**: Software tools developed to find certain information stored on a computer system (personal computer or internet) generally are referred to as a search engines. The search engine allows one to ask for content meeting specific criteria and retrieving a list of matching references. Search engines use regularly updated indexes to operate quickly and efficiently.
- **Content Catalogues**: Content Catalogues support the exchange of content or educational material. Conditions of exchanges can be set by the users in order to document access or to enable collaborative work and eventually to charge the use of the content.
- **Galleries**: Galleries are image data banks usually allowing the user to browse or search a graphic or document website with reduced images in order to view multiple images on a screen simultaneously or to download such images more rapidly. Images can be tagged to link to other forms of information such as keywords, texts, comments etc.

Authorware

Originating from a software product name, authorware programs are mainly used to produce interactive instructional media. Authorware is created to edit and develop multimedia (pictures, animations, simulations or exercises), interactive and dynamic course material and course navigation based on a structured flowline without special html- or programming skills. Commonly used application in e-learning is Macromedia's Authorware (www.macromedia.com) or Click2Learn’s Toolbook Instructor (home.click2learn.com) [4].

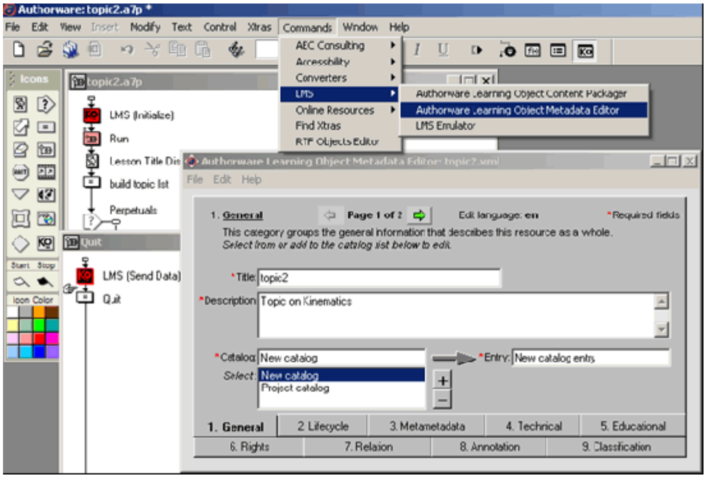


Figure 6. Sample screenshot of an author ware system (www.macromedia.com).

Simulations and Gaming

Simulations in education have been used to imitate real devices or interactions with the aim of conditioning and training ever since. With the resources of multimedia computer systems a virtual reality (synthetic environment) based on models can be generated which allows free or guided experiments to learn about attributes or correlations.

- **Physical simulation**: Simulation of a real object which is substituted by a physical object. Usually the real objects are simulated by a substitute because of their rare, fragile or expensive nature. Most physical simulations offer a variety of interactive features in which the substituted physical object is able to provide feedback to the user.
- **Virtual Simulation**: A computer generated virtual environment incorporating a certain degree of physical or economical relations is rudiment to most of the simulations in civil engineering education. Within this virtual environment it is possible to test and evaluate correlations of all kinds.
- **Gaming**: Simulations can be incorporated into games which allow its' application in a competitive situation in order to motivate the student. Since competition is an important factor for motivation, usually the involvement in gaming receives the highest level of student performance.

Assessment Tools

Assessment tools in ICT are software devices to document or measure knowledge, skills, attitudes and beliefs. There are two main types of assessment [7]:

- **Summative Assessment**: A summative assessment is usually done at the end of a course or project in order to examine a student's comprehensive knowledge and allow accreditation for a certain course grade.

- **Formative Assessment**: Formative assessments are carried out during a course or project providing *"on the fly"* feedback on the student's current status and work progress. Sometimes formative assessment is used to identify a suitable program of learning in relation to the student's current knowledge. This form of assessment may be used by the teacher or for self evaluating purposes.

Assessment methods are commonly differentiated depending on their approaches between *subjective* and *objective*. While objective approaches expect a single correct answer or a straight numerical solution, subjective assessment allows different answers as well as various ways in expressing it. "Yes/no", multiple choice and matching questions are typical objective question formats. Subjective questions are open-response questions, presentations and essays.

Due to it's compatibility in processing, objective assessments are more often used especially if the exercise is carried out electronically, e.g. using an online questionnaire. Assessment should be valid and reliable.

Content Management Systems (CMS)

A content management system is used to manage and facilitate collaborative content creation. With a fixed design template and structure the CMS provides a simple interface for the users to add or modify existing content material which may be automatically published. The CMS's interface often utilises plain text input with predefined tags using set rules to style the new content and in order to maintain a consistent design. The set CMS structure is used to manage the workflow.

Learning Management System (LMS)

A Learning Management System (LMS) or a Managed Learning Environment (MLE) usually represents a software package combining competency management, skills-gap analysis, succession planning, certifications, virtual live classes, content management, content authoring, and resource allocation on a large scale. Offering an easy navigation menu and personalised access rights, in most cases a LMS includes the following elements:

- **Scheduling and Organisation:** The syllabus for the courses and administrative information, assessment procedures as well as online display of news and notice boards.
- **Administration:** Online student registration, enrolment and tracking and sometimes in addition with the opportunity of online payment. Some LMS also offer advanced facility management systems
- **Course Content:** Educative material and course content is provided online through a quality controlled environment. Also supplementary tools, resources and library or databank access are managed online.
- **Assessment and Accreditation:** Along with evaluation tools, skill profiles of the students are managed in order to record course and module graduation. In some cases self-assessment or direct feedback tools are provided.
- **Measurement of Performance:** The utilisation and performance quality are measured and the results are stored and managed (documentation and statistics).

In a LMS authoring tools are available for teachers usually in combination with a help desk or support system. Most LMS are in some way demanding a certain structure or format also in relation to a uniform appearance of content and thus may set a limit to creativity.

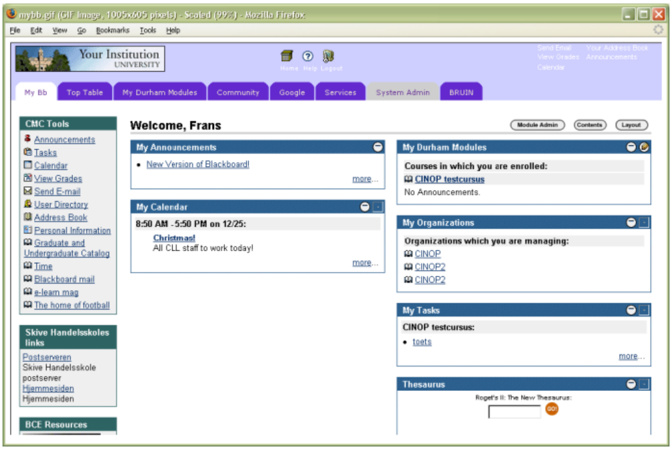


Figure 7. Sample screenshot of a learning management system (www.blackboard.com)

There are a number of commercial and open source programmed LMS available. Typical examples for commercial products are Blackboard (blackboard.com), Desire2Learn (desire2learn.com), WebCT (webct.com). Examples for free open source programmed LMSs are Moodle (moodle.org) or OLAT (olat.org).

Educational Blogging

Blogger (or weblogs) basically are common webpages with periodic time stamped posts (text, audio, pictures or video) often used as online live journals. Recently the easy handling of bloggers (and the fact that many students nowadays are already familiar with the system) in combination with the possibilities to publish, link, comment and chronologically store content led to its utilisation for educative purposes. Project work can be directly published allowing a direct feedback from the public. Numerous educational experts routinely publish their personal explorations in blogs [8]. Some examples of hosting services are blogger.com, livejournal.com, movabletype.org or wordpress.org.

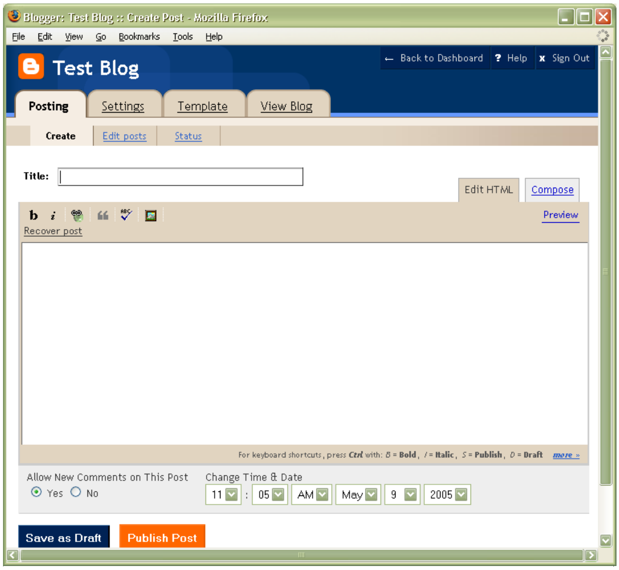


Figure 8. Sample screenshot of weblog interface (www.blogger.com)

Wiki-projects

Wiki-systems are based on open-source software allowing the creation of encyclopaedias on defined terms by enabling easy editing, linkage and discussion by open source or restricted authors.

Figure 9. Sample screenshot of wikipedia (www.wikipedia.org)

The multilingual Wikipedia (wikipedia.org) already offers its free content in more than 60 languages and provides over 2.5 million articles. Although its numerous authors are volunteers the reliability of the content is granted by administrators.

4. OBJECTIVES OF THE APPLICATION OF ICT IN CIVIL ENGINEERING EDUCATION

Since there is a great variety of ICT tools supporting many different kinds of educational activities, miscellaneous objectives can be pursued by applying ICT. Therefore it is regarded as essential to be aware of the special desired objective in order to apply ICT in a sensible and effective way. Although teaching and learning is strongly linked together distinction is being made between applications targeting student's or teacher's needs.

Objectives for the Student

To acquire *Practical Experience* (technology integrated learning) for best performance and employability, it is necessary to train the students on up-to-date and progressive software tools. Computer Aided Design and Modelling (CAD and CAM) have long been part of the building process as well as virtual simulations like Finite-Element-Method Analysis (FEM). In today's professional life the capability to use modern communication tools is seen as obligatory as well the ability to quickly adapt to innovations.

It has been commonly agreed that new developments in ICT have a strong impact on the students *Learning Style* and *Learning Environment* supporting the shift from teacher-centred to student-centred learning [9].

Table 2. Key elements of teacher-centred and student-centred learning

Teacher-Centred	Student-Centred
Facts	Problem-solving
Individual effort	Team skills
Passing the test	Learning skills
Achieving the grade	Continuous improvement
Individual courses	Interdisciplinary knowledge
Receiving information	Interacting & processing information
Technology separate from learning	Technology integral learning

Most of the key elements of student-centred learning are difficult and time consuming if one seeks to apply them without taking advantage of modern technology. Interactive tools and gaming can be used to enhance the motivation as well as improve the learning- and problem-solving skills. The increasing availability of resources of information through intra- and internet supports students' activity within the learning process and the development of life long learning skills. Since most educational material which is available through multimedia or the internet is not bound to a specific schedule students learning becomes more independent of time & space (distance learning). Multiplied resources also foster an interdisciplinary approach to solving problems.

Objectives for the Teacher

One important difficulty in teaching is the amount of workload and the lack of time in order to focus on the students needs. Modern ICT can assist teachers to spend less time in preparation of teaching material (sharing of content, automatic processing) and enable them to incorporate all sorts of multimedia within their presentations. Time might be more efficiently used if parts of the educational content can be used in self-guided or tutored e-learning activity. In addition to this, the flexibility of time spent can be improved by using the various possibilities of communication to interact with or even to involve the individual students.

Electronic assessment tools allow the estimation of students' knowledge skills during certain stages of the course program. Based on this information the educational content can be modified during the course to optimise the results. Within the process of quality control there is a variety of self-assessment tools available to teachers.

The availability of multiple resources triggered collaborations and exchange of research- and teaching information on a global scale. Information now may also be available as open source (e.g. wikipedia.org) or as a groupware and trigger own new ideas or spread an idea either in a free or commercial environment.

5. GOOD PRACTICE IN E-LEARNING

EXAMPLE OF E-LEARNING -VIRTUELLE HOCHSCHULE BAYERN (Ralf Reinecke)

The *Virtuelle Hochschule Bayern (VHB)*, or Virtual University of Bavaria (www.vhb.org), supplements the range of courses available at Bavarian universities, providing a more effective course of study, while at the same time injecting fresh impetus into university education. The VHB supports and coordinates the application of multi-media tools in education and training. So far the VHB does not offer 100% e-learning courses, but instead provides a functioning blended learning system with the opportunity to increase the e-activity gradually up to its optimum.

The virtual university is directly associated with all 9 Bavarian universities and 17 polytechnics as an interactive multimedia network and offers high-quality online lectures hosted by Bavarian professors on the Internet. Trained tutors supervise the courses developed at the respective universities. The web based multimedia teaching and education format is both independent of time and location for the individual user (open free of charge to any student and lecturer of the Bavarian universities and polytechnics).

While other e-learning systems also manage teaching facilities such as rooms or media equipment (e.g. beamer) the idea of the VHB was to compile and produce educational material from among the participating institutions and publish it through a shared web based portal. Due to this, existing multi media could be shared and new impetus for enhanced teaching given to the universities.

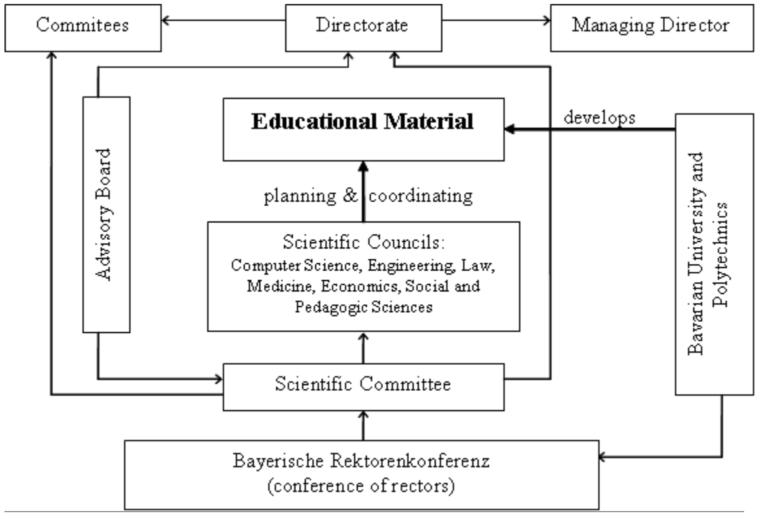
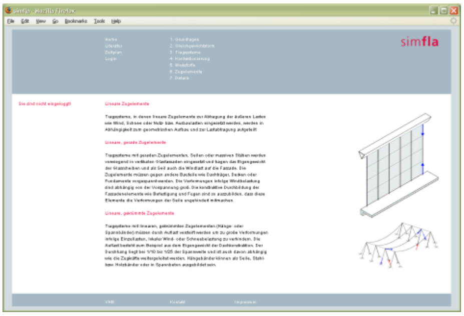


Figure 10. Structure of the organisation of the virtuelle hochschule bayern

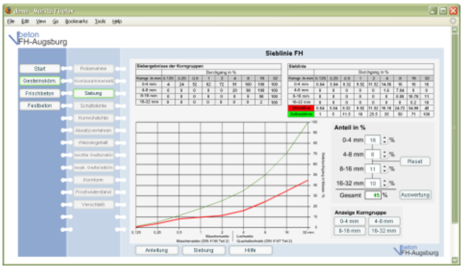
Figure 11. Sample screenshot from the platform layout of the virtuelle hochschule bayern

Currently the VHB offers 83 courses, 48 modules and additional tools and applications. Courses are divided into *A* and *B*: *A*-courses are performed on a regular base with tutorial support. These courses are acknowledged by the scientific committee and enable the participating student to gain credit points using *FlexNow* [6] (credit-point-system software). In addition to this, the *B*-courses are created to provide further educational content as a supplementary to the main studies.

Modules are parts of a course programme which do exist mainly in supplementary and second cycle studies. As a blended learning activity modules are generated to support the face to face teaching and to enable repetition of lectures content. Some modules are also applied in regular university teaching as well.



Standard Lecture, FH München, Fachbereich Architektur



Virtual laboratory, Material Sciences, FH Augsburg

Figure 12. Sample screenshots from teaching content of the virtuelle hochschule bayern

Tools such as encyclopaedias, specific science- and content catalogues, simulations, glossaries and virtual labs are available for students and teachers as well as scientists. For the students they should facilitate a self-learning environment which provides easy accessible resources. Tools can be incorporated into course programmes or used to enable open source activities.

The course program in general is continuous and allows accreditation according to general Bavarian examination regulations (examination must be taken in person at one of the associated institutions). Besides Engineering, the course programmes also cover IT, medicine, key qualifications and economics, teacher training (pedagogical science), law and social studies.

The project was financed with 11.2 million euro during the launching phase from 2000 to 2002 and is granted a budget of 3.6 million euro per year paid by the state (confirmed until 2006). At present approximately 10,000 students are using the course programmes and are dependent on the state funding.

- Virtual Campus Bavaria (www.vcb.de)
- Virtual University Baden-Wuerttemberg (www.virtuelle-hochschule.de)
- Virtueller Campus Rheinland - Pfalz (www.vcrp.de)
- Studieren im Netz - a search engine for study opportunities in Germany (www.e-studying-in-germany.de)

EXAMPLE OF A DIGITAL LEARNING ENVIRONMENT - BLACKBOARD ON CITG TUDELFT (Kees van Kuijen)

On TU Delft we use Blackboard version 6.2. There is a Central 24 hour server system with office hours helpdesk. Blackboard is for all students, teachers and co-workers. External accounts are made for guest teachers and guest students. We have a Technical Support Service (DTO) which handles the technical environment of Blackboard like migrations, new features and building blocks (portal functions, web mail, portfolio, web directory, group tools, CMS, etc)

As the Contact Person I look after the implementation, advice and support on the Blackboard application. As a former Teacher I can also provide fellow teachers with didactical support on the use of Blackboard. Most of the Questions were on Multimedia in education. We give support by telephone (on the job) by mail or on site (at their workspace). We developed some workshops and manuals on the elementary use of Blackboard for as well students as Teachers.

When teachers want to put film in their content we develop a module which can be used in blackboard. Blackboard isn't flexible enough to our needs so we put our home made modules on a different web server. Through the authentification module in blackboard the modules seems to be a part of Blackboard.

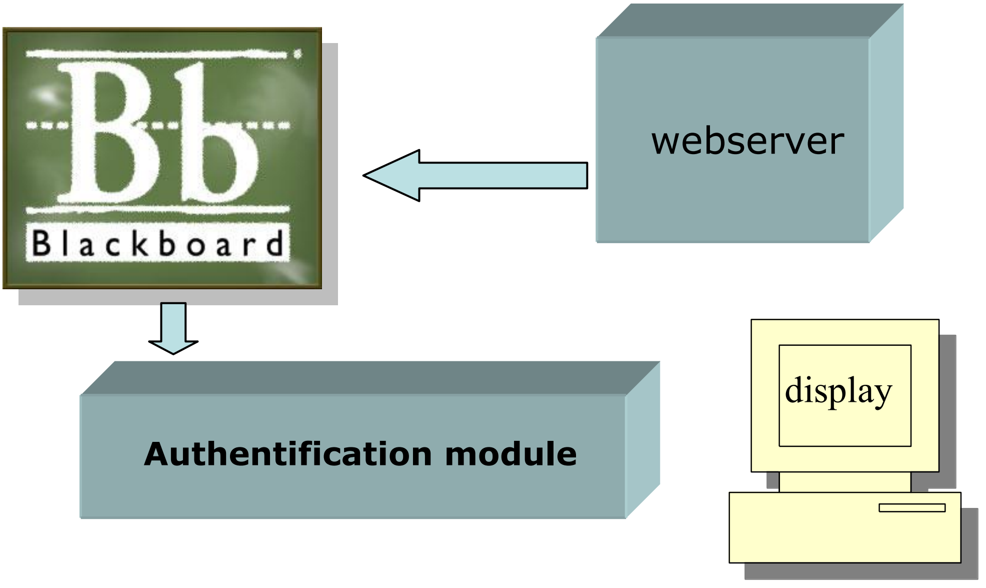


Figure 1.3 Scheme of workflow facilitating blackboard

Research on Logistic quality

Some time ago there had been a discussion about the logistic quality at CiTG. Blackboard was also mentioned in that discussion. A better use of Blackboard can lead to a better communication with students. Many students don't know which person they can ask questions, because no person is mentioned on 'Staff Information'. The motivation of students can improve strongly, if they can use a well filled Blackboard, which provides relevant information, including photographs and movies. The students can use the information as a work of reference for their study. They can perform work in groups. There will be fewer misunderstandings about information of marks and tests. Assignments will be better understood, if they are described clearly and can be found on Blackboard.

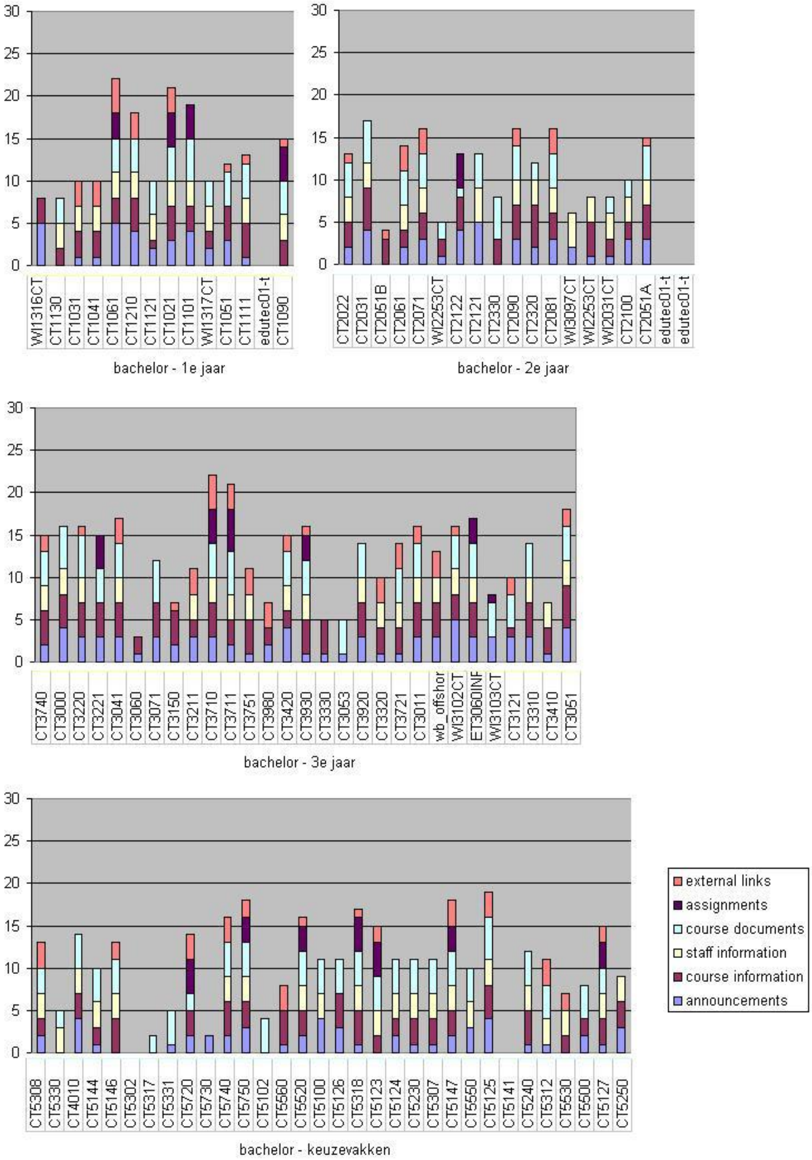


Figure 14. Results of the investigation on blackboard application in the courses

As a result of the above mentioned discussion about the quality control of Blackboard, the Multimedia Studio has executed an investigation, which gives us a reasonable insight in the use of Blackboard by teachers. Knowledge about the quantitative and qualitative (didactic, educational) use of Blackboard can stimulate a teacher to improve his use of Blackboard. That's exactly what we want to achieve with this investigation. A better use of blackboard is an advantage for students, who will appreciate a widely used Blackboard, which includes an equivalent use by different teachers.

- **20/30 points:** If a course achieved 20 to 30 points, we can say that the course is excellent. There are PowerPoint presentations and multi media is used. The information is an important source of information for the study. All possibilities of Blackboard are well used.
- **10/20 points -** If a course achieved 10 to 20 points, we can say that the course is good, but not all possibilities of Blackboard are used.
- **0/10 points** - If a course achieved 0 to 10 points, we have to say that the use of blackboard is not good. Information is insufficient, many possibilities are unused. The course is not useful for the study.

Support

A few years ago we started a Multimedia Studio where instructors can get all the answers about ICT in education. Of course, all on behalf of Blackboard. Answers like:

- How can we put our sheets on blackboard
- How can we digitalize our vhs, u-matic tapes
- How can we put film on Blackboard
- How can we digitalize slide's (archive disclosure on the web)
- Can we use pictures in our presentation (gallery)
- How can we do videoconferencing
- Can you film this and that
- Can you etc.

With the help of trainees an student assistants we try to do it al at low costs.

New developments in education concerning Blackboard

- **Web-suited lecture notes** - We try to initiate a different way of putting Word documents on the web. It is possible to put a series of files (from one or different modules) in a shell of interactivity. (HTML based)
- **Authoring tools to rewrite curricula** - With an authoring tool (Easy Generator)it is possible to make lecture notes combined with multimedia in an easy way so that ever content producer can produce web based lecture notes.
- **Kernel lectures** - Some pieces of content can be easily filmed and put together with a PowerPoint presentation. This Kernel lectures must be very short (modules of about five to ten minutes).
- **Lecture feedback** - With nowadays techniques it is possible to easily film a lecture on the fly and put it on the web. All you need is a laptop and a (web) camera. If instructors admit self-diagnose Questions and allow students to react on these lectures through a discussion board, this provides an enormous feedback for instructors as well as students.
- **Remote lectures** (Videoconferencing, Collaboration) - Even lectures between universities can be broadcasted through the web.
- **Gaming** - In order to give lectures more retention we can search and find new ways of keeping student attention to the lessons.

Trial Study for new students

New students get acquainted with blackboard through a project we call “Test or Try-out Studying”. In their last year of high school they are invited to come and see for themselves how it’s like to study on our university. We provide them with a guest account and let them show how Blackboard ‘feels’ like. We also use this blackboard site as a showcase for teachers so they can see how it can be done.

We also give them lots of information, which they can use for their ‘End Study Task’ of high school.

EXAMPLE OF A DIGITAL LEARNING ENVIRONMENT - MOODLE AT THE UNIVERSITY OF ZILINA (Jan Bujnak)

Environment Analysis

As it has become clear today, education is global in the same way as economy. This is due to faster knowledge spreading, as well as usage of new technologies. As any external influence to the system in equilibrium, the impact of foreign educational institutions to the educational market in Slovakia will bring new challenges but new risks too. As it has been mentioned above, the e-education implementation is long-term process. Even if the final goal is to offer some courses world-wide, we start at the Slovak universities to apply the e-education at the Slovak market mainly. To create the e-education system efficiently, it is advantageous to negotiate between universities with the similar courses to establish a common core of curricula. In this way the number of students using the same education tools will be increased and the expected investments of effort and money will be efficient. It is not easy to accept this concept of common core for universities. We have a specific situation in Slovakia. Based on new Act on Higher education the number of study branches should to be reduced. Big discussion about it is going on. It will be good, if the subject of the e-education is included in this discussion. The individual approach cannot be successful enough. In accordance to that, it can be assumed that larger step towards the e-education may be done only by the mutual co-operation of universities. It will be necessary:

- to identify education processes which will bring the biggest progress by using of the e-education principles
- to develop a new pedagogical approach for the e-education implementation in internal or external forms
- to understand the new teacher’s role
- to analyse human resources, and the existing infrastructure
- to develop a complex methodology how to implement the e-education to the existing university education system

It is not possible to implement the e-education simultaneously at all universities, and pilot projects are running on several universities at the present time. However it will be necessary to have some coordination to identify barriers, and to propose how to overcome them, regardless their source. This may concern methodology, human resources and infrastructure.

It would be ideal if the methodology came first, and afterwards step-by-step implementation followed it. It has been planned by the Slovak Ministry of Education to develop a strategic plan for the IT implementation at universities, and one part of it will be oriented to the e-education. Parallel projects for the e-education have been supported. At the University of Zilina, we follow two different approaches. Due to requirements on the fast implementation, which is important from psychological point of view, existing courses like Cisco Networking Academy and IBM e-business Academy have been implemented. From our perspective, it is also important the fact that these courses were implemented concurrently at two other Slovak universities. This creates opportunities to co-ordinate also other courses in a bachelor study. Parallel to that, new multimedia courses on subjects in which the departments have a strong scientific background, were developed.

Implementation of Electronic Support of Education

We have used the general methodology to the implementation of the e-education service. Some experience obtained during this experiment is described below.

Specification and Description of e-Education

University uses the following documents as a starting point:
*e*Europe+, Action Plan prepared by the Council and the European Commission.,
Recommendations given by EUA in last four years.

The Action Plan for eEurope+ activities brings specific e-educational actions together with a complementary e-education initiative that is being launched. The e-education will encompass *e*Europe targets in an educationally oriented framework and will address the request to adapt European education and training systems to the knowledge of society.

Forecasting and Planning of the e-Education

The ideas of the mentioned documents lead us to consider the implementation of the e-education service as the main item of the global university strategy. Therefore the university management has developed a strategic plan, and offered it to general discussion. The implementation of the e-education leads university staff to new roles and unknown activities. To make these new roles more advanced, it is very important to explain all reasons why e-education and why this strategic plan has been developed.

Technology of the e-Education Specification

Comparing the e-education with "stone universities", we can see a new business model of education. There are new players in the e-education, and the roles of the players are changed. The following table shows the new structure of the players in the e-education.

This change of players and roles will bring change to the university staff structure, establishing new positions and change in teaching methodology. Each position in the new value chain has to be described by activities and interfaces. New roles implementation to the existing structure creates several problems: communication is running within established groups, which is not effective in a new structure, people obtain new tasks without discarding the old ones, etc. On the other hand, the university transformation has to be realized. Based on that the university has prepared a new status in which new tasks given by the e-education are also reflected.

Table 3. e-Education Value Chain

e-Education Players	**New Roles**
Student	Distant Learning Using worldwide information electronic sources
Producers	Design and implementation of the e-education Allocation of budget covering higher starting costs Diversification of budget sources
Organizers	Taking more responsibility for the content (course coordination) Generating of multimedia courses according to given scenarios Creation of a new education management system
Teachers	Finding a new model of student tasks Distance helping for students Knowledge of most relevant electronic information source Student coaching
Provider of network infrastructure and network	Building up and operation of network infrastructure including servers
e-learning technology suppliers	Low end client equipment Application software Authoring systems for multimedia courses creation
Provider of courseware server	Building and operation of courseware server Data security Courseware maintenance
Providers of multimedia courses	Building and operation of authoring systems Cooperation with content creators and scenarios creators
e-learning service management	Service operation and maintenance Students authorization and authentication Billing

Process Analysis

When information & communication technologies are used in the existing educational process, they do not bring necessarily a new solution of education. They only replace former manually or mechanically done activities that improve the quality and effectiveness of the educational processes. To bring new solutions and inovations is necessary to rebuild the existing educational process. For this purpose a business process reengineering methodology can be used. The process of education is important from the teacher’s point of view, namely in the sub processes:

- process of teaching,
- process of study materials preparing,

- process of examination.

We have analyzed the educational process at our university using structural analysis based on flow graphs for different levels of details. For each process an information flow chart has been designed.

New process Design or Process Redesign

For creation of new educational process needs we need to identify barriers, and propose their overcoming, according to possibilities, which are given by the implementation of new information & communication technologies. The inputs to the new processes design are:

- critical analysis of the existing processes in education
- understanding of the new information and communication technology possibilities.

The new process creation is possible based on the application of a reengineering method, problem analysis and the formation of a problem hierarchy together with the knowledge of opportunities that information & communication technologies provide. The procedure of new processes design includes:

- definition of crucial processes parameters,
- the implementation of new information & communication technologies impact and its evaluation,
- alternative solutions design,
- solutions evaluation, and selection of the most appropriate one.

Preparation Feasibility Conditions

Anyhow progressive the e-education might be, there is always a possibility that many of teachers will not accept it enough. A new way of thinking is required for all players in the new value chain. They have to change their behaviour which they used without the e-education, and transfer their knowledge and experience from the traditional education into the e-education. If they are not familiar with the principles of the e-education, it is very probable that they will try to prevent the changes. They want to prevent them, because they do not understand new requirements. If all players see their roles in the new educational process, then they will accept changes and they will more actively participate. It is necessary to start soft processes supporting creativity, like brainstorming, supporting common goals of the university, supporting culture of the university. Collective responsibility for general success of the university can be motivating. But building up the new organisation culture is a long-term task.

User Requirements Specification

The users of the e-education technological systems are teachers, students and administratve staff. Priority and perspectives of students, teachers and administrative staff are different, and it seems to be a never-ending story to find a consensus. It is not possible to implement all aspects of the e-education immediately at university as whole. The following functions were specified as the most important:

- making study material public
- communication with students
- study management
- testing of knowledge
- exam management
- courses evaluation by students

Technical Structure Design

Learning Management System Moodle as “open source” creates the base of the e-education system at the university. This system provides an access to knowledge testing system, exam management system as well as course evaluation system. This system fulfils the basic requirements of teachers and students. Institute responsible for implementation of ICT in to university processes has developed based on previous design of new processes software and hardware environment, which has included this open source system in to system, which supports utilisation of ICT in administration of education. Now we can speak therefore about e-university. We have been testing the e-education system since the winter term of academic year 2003-04. Full system is accessible on http://vzdelavanie.utc.sk.

Conclusion

Information & communication technologies bring new tools to education. To highlight their impact comparing with non-electronic tools, term e-education is used nowadays. This term will probably disappear when these tools will be such as natural part of education technology as for example books are currently. In the meantime, many universities have implemented these tools to their education. We can see many pilot projects at universities, but from our perspective, blank experiment cannot be used as a method for a mass implementation. Methodology of e-education implementation has to be developed. We propose basis of such methodology based on three-partial systems.. We have recognised that using this methodology gave us more certainty in the complex task of the e-education implementation. We have also learned that e-education implementation is not a single-shot task, but it continues in spirals. It was happened when for example a complex learning management system (LMS) was replaced by simple, tailor-made LMS as a starting solution, to attract more teachers to play this game with us.

6. REQUIREMENTS

Before applying ICT for a specific task, it is necessary to be aware of certain requirements which can confine or even eliminate the expected impact. Requirements can be of technical, individual or comprehensive nature and with some being firm or unchangeable they might even define the limit of possible applications.

Students

Technology keeps constantly changing and introducing new tools necessarily is bound to providing the respective training. In many cases the students' expertise is set at a quite high level enabling them to handle new technologies without preliminary training if there is a sufficient support available.

The downside of student-centred learning can be that the student needs to be an active learner as some kind of prerequisite since passive behaviour might lead to be unnoticed if there is no obligatory feedback or tutoring involved in the e-learning activity. The student also has to face problems occurring during the use of the ICT interface which might lead to frustration if the student lacks of good troubleshooting skills.

On the technical side, the student needs to have access to necessary hard- and software resources. Hardly any application can truly be platform independent which means that missing requirements have to be provided by the institute or there will be a high demand on individual solutions in order to keep all participants at the same level.

Institutions / Teachers

The personal expertise in technology is a critical factor for the teacher as well as for the student. Since the teacher does lack of time to be an expert in the latest technological developments, there is a strong demand for the universities to foster an IT division. This division can manage and support the staff in order to keep their technological expertise requirements at a minimum. In that case the teachers basically just need the motivation to be aware of the given tools and to rely on support if problems occur during their application. In addition to this, the design of the content becomes increasingly important since in some cases it is the first and/or only appearance to the students. Clear navigation and instructional design are obligatory if the educative content should be efficiently transferred to the student.

A major difficulty for the application of modern technology can be the financial aspect in terms of costs of development, purchase, training and maintenance. Without a focus on the prospects of the application it seems rather challenging to accept those costs as an investment. As the process of innovations speeds up it is a vital financial factor to be able to judge whether a system is sufficient and is able to remain applicable and adjustable to new technologies within a certain time frame.

During the utilisation throwbacks and points of frustration on the teachers side as the user of the systems needs to be minimised but can not be totally excluded. This means that an attitude needs to be fostered to be able to accept points of failure without abandoning the process.

With the growing importance of the internet the global competition sharpens also for the teaching institutions. Education is not any longer bound to a specific location and a student's choice for one specific university is less limited by their actual residence.

7. PROPOSALS FOR THE IMPLEMENTATION OF ICT APPLICATIONS

Considering the big differences among the various teaching institutes within the application of ICT it is important to support teachers who are motivated to take the first steps in the area of e-learning. Since some members of EUCEET already possess extensive experience based on continuous examples of good practice, some suggestions can be provided:

- Define your goals (What do you aim for in applying ICT?).
- What is the starting point (What kind of resources/expertise do you and your students have?).
- Start with the next most simple steps (How can you improve the system without changing it completely?).
- Use consistent and common tools (Are there examples of good practice in the area you are interested in?).
- Acceptance of essential investment, time and first failures (What are the prospects of the application?).
- Create a good support (How many users on how many different systems need support?).

Without the knowledge on what you would like to achieve by using ICT it will be difficult to obtain results that justify the investment of time and money. The goals usually lead to a number of possibilities of tools and systems which serve a similar purpose. Depending on the currently used standards some tools and systems become difficult to incorporate without having to change the system as such. In some cases such a huge investment is inevitable but will often create a reorganisation and reorientation phase in which the newly applied systems can't work properly. In many cases there is a suitable "*building blocks*" solution to stepwise move to a higher level.

If an investment to achieve a certain goal is accepted, it is necessary to keep in mind that the developed or purchased systems should be consistent and should offer commonly shared interfaces. To detect promising systems which provide these attributes it can be a great help to accumulate examples of practice and experience of users. Proving a categorised recommendation in this paper does not seem useful since both commercial- and open source- or GNU products may have advantages and disadvantages regarding their consistence.

During the launching phase and calibration process users will experience points of frustration which may have a threatening effect on the utilisation if no sufficient help to continue can be provided.

Although usually examples of good ICT practice in civil engineering education are based on the work of enthusiastic individuals, some universities already realised the growing demand for an expertise in modern technology. They invested in learning management systems with a supporting IT division, allowing the teachers to focus on the educational or research related aspects of their work instead of attempting to keep up with the latest technological development.

Excellent learning management system exist either commercial or open source which can be adapted in order to improve the institutes performance in total. Their application should not be driven by creating a 100% e-learning environment but by facilitating a more student centred learning environment and the ability to offer blended learning where both e-learning and traditional ways of teaching have their expedient place.

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Report of the
Working Group for the
Specific Project 7

Harmonisation of European construction codes and regulations

HARMONISATION OF EUROPEAN CONSTRUCTION CODES AND REGULATIONS

Josef Machacek[1]

PREAMBLE

This report containes a brief introduction, overview of the process on harmonisation of European construction codes and regulations in the last decades and the main summary of the work of Task Force SP.7 of the EUCEET Thematic Project 104437-CP-1-2004-1-FR-ERAMUS-TNP. Each part of the report represents work processed by the attributed author(s), specialised in a particular Eurocode. The active members of the group were:

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TABLE OF CONTENTS

[1] Chairman of the WG for SP 7, Czech Technical University Prague, Czech Republic

1. INTRODUCTION

Task Force SP.7 started working after EUCEET General Assembly (GA) in Athens (20-21 February 2003). All active members were present at GA.

Objectives of the Specific project SP.7 as stated during EUCEET GA in Athens:

The project under EUCEET II Network Programme will be oriented towards the pedagogical aspects of Eurocodes. Member (and associated) States of CEN should implement Eurocodes together with consonant product standards and guidelines for civil engineering works in the immediate future. There is a task for universities to prepare their graduates for being familiar with taking Eurocodes as reference Standards at least in European region.

Education of new generation of civil engineers may not, of course, be “code based” but “concept based” in its methodology. Nevertheless, the students should be aware of the sense, principles and basic use of the European standards, especially in project based learning. To be able explaining these procedures in necessary detail by a teacher, however, requires to be either involved in the work of the corresponding Eurocode project team or to study the background documents (if available).

Therefore, it was suggested to collect a list of significant background documents, teaching aids and educational software for each of the individual Structural Eurocodes or other important European regulations. Such list of documents in particular specialized field could help teachers with better orientation in using Eurocodes.

Working methods as agreed during EUCEET GA in Athens:

EUCEET participants active and interesting in individual Structural Eurocodes and possibly other important European regulations in the field of civil engineering will subdivide the work into particular code teams (see summary of Prague Meeting for the teams). Each team of specialists will prepare list of basic significant background documentation of the relevant Eurocode. The members of the team will be in E-mail contact.

Outcomes as agreed during EUCEET GA in Athens:

The list of background documentations relevant for each Structural Eurocode or other European regulation important for civil engineering education will be prepared for publication under EUCEET II project.

Information on the work of the SP.7 group and following outcomes will be submitted for publication also in AECEF Newsletters.

Activity plan as agreed during EUCEET GA in Athens:

a) February 2003: First General Assembly, Athens

Presentation of the basic information. Discussion on the process concerning Eurocode programme, formulation of goals, outcomes, activity plan and subdividing interested participants into specialized teams.

b) Continuously between February 2003 - May 2004 (electronic contacts)

Work on collecting materials, electronic discussion of new ideas.

c) 17th October 2003: Meeting of the SP.7 working teams, Prague

Reports on acquired results, discussion about other work, decision on form of results and their presentation.

d) May 2004: Second General Assembly in Malta

Presentation of the results, preparation of Final Report of SP.7 Task Force.

Prague SP.7 Meeting on 17 October 2003:

The Meeting was attended by:

Mr Ion Berca, Prof. Zdenek Bittnar, Prof. Luis Calado, Prof. Marie Ange Cammarota, Prof. Anikó Csébfalvi, Prof. György Farkas, Prof. Andrej Lapko, Prof. Antal Lovas, Prof. Vaclav Kuraz, Prof. Josef Machacek, Prof. Iacint Manoliu, Prof. Karl Oiger, Prof. H. Sertler, Prof. Jiri Vaska, Dr. Jiri Plicka.

After presentation of materials prepared by representatives of respective teams and fruitful discussions the recommendation for future work was agreed. Especially extent and format of the Final Report and working teams were fixed as follows (at the time some non-active members were also included into the teams):

Eurocode 0 Prof. Wolinski, (Prof. Berkowski)
Eurocode 1 Prof. Wolinski, (Prof. Berkowski, Prof. Totev, I. Berca)
Eurocode 2 Prof. A. Csébfalvi, (Prof. A. Lapko, A. M. Schiau, Dr J. Fonseca, Prof. Fischinger)
Eurocode 3 Prof. H. Sertler, (Prof. J. Machacek)
Eurocode 4 Prof. L. Calado
Eurocode 5 Prof. K. Oiger, (Prof. I. Totev)
Eurocode 6 Prof. A. Lapko, (Prof. A. Csébfalvi, A.M. Sciau, Dr J. Fonseca)
Eurocode 7 Prof. R. Kastner, (Prof. R. Frank)
Eurocode 8 Prof. R. Blazquez, (Dr Fischinger, Prof. Boduroglu)
Eurocode 9 Prof. J. Machacek, (Prof. H. Sertler)

2. OVERVIEW OF THE PROCESS ON HARMONISATION OF EUROPEAN CONSTRUCTION CODES AND REGULATIONS

The Commission of the European Community (CEC) decided on an action programme in the field of civil engineering construction already in 1975. The objective of the programme was the elimination of technical obstacles to trade and the harmonisation of technical specifications.

A Steering Committee with Representatives of Member States was established which developed the first generation of European codes during following 15 years. In 1989 the CEC and States of EFTA decided, based on agreement between CEC and CEN

(European Committee for Standardisation), to transfer the preparation and the publication of these technical rules (known as Structural Eurocodes) to the CEN. The initial idea consisted in elaborating so called **European Prestandards ENV** for use in the first 3 year period as an alternative to the national rules in force in the Member States which would be replaced later by **EN Eurocodes**.

The process has had direct links with Council's Directive 89/106/EEC on construction products (called CPD: Construction products directive) and Council Directives on public works and services (93/37/EEC, 92/50/EEC, 89/440/EEC).

The technical aspects arising from the Eurocodes need to be appropriately considered in work on **product standards** to achieve a full compatibility with the Eurocodes. This is done by the CEN TCs (Technical Committees) and EOTA (European Organisation for Technical Approval) Working Groups which work on harmonised product standards hENs, ETAs (European Technical Approvals) and ETAGs (European Technical Approval Guidelines).

The Eurocodes may be considered as part of **Interpretative Documents** mentioned in CPD (which shall give concrete form to the essential requirements specified by CPD, indicate appropriate methods and serve as a reference for the establishment of harmonised standards and guidelines for European technical approvals).

Therefore, the Eurocodes should serve as reference documents for following basic requirements:

- To prove a harmony of civil engineering works with essential requirements of the CPD, especially:
  - Essential Requirement No 1 - Mechanical resistance and stability;
  - Essential Requirement No 2 - Safety in case of fire.
- As a basis for specifying contracts for construction works and related engineering services.
- As a framework for preparation of harmonised technical specifications for constructions products (hENs and ETAs).

Recent work:

The work is coordinated by CEN/TC 250 - Structural Eurocodes (chairman Prof. H. J. Bossenmeyer), having close contacts with European Commission, CEN TCs, EOTA WGs and member state national delegations.

The EN Eurocode programme comprises the following 10 standards (initially 9 Prestandards, in which the Basis of structural design and Actions on structures formed one common ENV 1991):

EN 1990	Eurocode 0:	Basis of structural design (1 part)
EN 1991	Eurocode 1:	Actions on structures (10 parts)
EN 1992	Eurocode 2:	Design of concrete structures (4 parts)
EN 1993	Eurocode 3:	Design of steel structures (20 parts)
EN 1994	Eurocode 4:	Design of composite steel and concrete structures (3 parts)
EN 1995	Eurocode 5:	Design of timber structures (3 parts)
EN 1996	Eurocode 6:	Design of masonry structures (4 parts)
EN 1997	Eurocode 7:	Geotechnical design (2 parts)
EN 1998	Eurocode 8:	Design of structures for earthquake resistance (6 parts)
EN 1999	Eurocode 9:	Design of aluminium structures (5 parts)

These standards generally consist of several parts. Between 1992 and 1998 were published totally 62 Prestandards (ENVs), which were implemented by Member States (and some others) together with National Application Documents (NAD), allowing to substitute indicative values (boxed values) of certain safety elements by national ones and providing general guidance and other reference standards during Prestandard period.

European product standards as harmonized technical specifications shall be in full agreement with the Eurocodes. In accordance with CEN resolution (BTS 1-11/1992, BT 23/1992) the TCs should refer in their standards to the Eurocodes wherever possible and consult any additional ("innovative") rules with TC 250. Member states should avoid possible discrepancy between product standards and design codes and adapt or at least enable optional use of Eurocodes.

From 1998 conversion process has started to rework the 62 Prestandards (ENVs) into 58 **EN Eurocodes**. The work is being done by CEN/TC 250 and publication of the EN Eurocodes is to be expected between 2002 and 2006. The work is organised through Project Teams (PT) established for each part of individual EN Eurocode and corresponding National Technical Contacts (NTC) of all Member States. To harmonize important common issues for all EN Eurocodes there are organised also horizontal groups (e.g. for fire, bridges, terminology).

Instead of National Application Documents (NAD) accompanying ENVs, the **National Annexes** (NA) are under preparation for EN Eurocodes. These include the responsible determination of the levels of safety (reliability) of civil engineering structures and works, including aspects of durability and economy, by Member States. These **Nationally Determined Parameters** (NDP) depend on possible differences of geographical or climatic conditions, ways of life or different levels of protection in the territory, and shall be prepared in accordance with permissible national choice given at particular EN Eurocode. They may contain e.g.:

- values and/or classes where alternatives are given in the EN Eurocode;
- values to be used where a symbol is only given in the EN Eurocode;
- country specific data;
- the procedure to be used where alternative procedures are given in the EN Eurocode.

This means, that the level of safety remains national responsibility.

The present work on EN Eurocodes follows Guidance Paper L (Application and use of Eurocodes, Brussels 2002). The stages are designated as follows:

- preparation of drafts (first PT draft - Stage 32, final PT draft - Stage 34, submission to CEN);
- examination period: max. 6 months (to verify an acceptability of EN Eurocode by general legislation of Member States, approving for going to formal vote, Stage 49);
- CEN process period: max. 8 months (covers voting and ratification, translation into all official CEN languages - English, French and German, ending with Date of Availability DAV, Stage 64).

Stages following DAV cover:

- translation period: max 12 months (translation into other Member States languages);
- national calibration period: max. 24 months after DAV (preparation of National Annexes with NDP);

- coexistence period: max. 5 years after DAV (adaptation of all conflicting national provisions) and ending with withdrawal of all conflicting national standards (date of withdrawal, DoW).

The plan envisages the full implementation of EN Eurocodes within 2008-2010, organised via "packages of EN Eurocode parts" to which are relevant parts grouped to enable common date of withdrawal for a particular design.

Current state (May 2004):

Stage 64 (DAV): 6 standards
EN 1990, EN 1991-1-1, EN 1991-1-2, EN 1991-1-3, EN 1991-1-5, EN 1991-2
Stage 49: 15 standards
Stage 34 or 32: 36 standards
Other: EN 1993-1-7 (cancelled)

Packaging of EN as given in Guidance Paper L:

- Eurocode 2 (concrete structures): 3 packages
- Eurocode 3 (steel structures): 6 packages
- Eurocode 4 (composite structures): 2 packages
- Eurocode 5 (timber structures): 2 packages
- Eurocode 6 (masonry structures): 2 packages
- Eurocode 9 (aluminium strructures): 2 packages

EN 1990, EN 1991, EN 1997, EN 1998 are materially independent and included into most of the packages. As an example the first package of EN 1993 is shown below.

Eurocode 3/1 - Building and Civil Engineering Structures, includes:
Basis of structural design (1 part): EN 1990
Actions on structures (7 parts): EN 1991-1-1 EN 1991-1-2 EN 1991-1-3 EN 1991-1-4 EN 1991-1-5 EN 1991-1-6 EN 1991-1-7
Design of steel structures (7 parts): EN 1993-1-1 EN 1993-1-2 EN 1993-1-3 EN 1993-1-4 EN 1993-1-8 EN 1993-1-9 EN 1993-1-10
Geotechnical design (2 parts): EN 1997-1 EN 1997-2
Design of structures for earthquake resistance (3 parts): EN 1998-1 EN 1998-3 EN 1998-5

Recent initiatives:

With growing awareness of importance of Eurocodes there are new initiatives across Europe. For example in UK were opened web pages “Eurocodes expert” in 2003, especially under care of Prof. Gulvanessian, giving references, showing new development, courses available and publishing journal Eurocodesnews (up to now there are 2 issues).

http://www.eurocodes.co.uk

Another important initiative is Leonardo da Vinci international project of 8 institutions, promoted by European Commission during years 2002 to 2005, with a main goal to produce Eurocode training materials. Coordinating institution is Klokner Institute of the Czech Technical University in Prague (CR), namely Prof. Holicky. Other institutions are Czech chamber of Certified Engineers and Technicians Engaged in Construction (CR), The Institute of Steel Construction of the University of Technology Aachen (Germany), Institute E. Torroja of Building Science (Spain), University of Pisa (Italy), Netherlands Organisation for Applied Scientific Research (Netherland), Institute for Metal Constructions (Slovenia) and British Research Establisment (UK).

http://eurocodes.cz

Outcomes of SP.7 Task Force:

Following pages contain materials collected by respective members of SP.7 group. During the work shortage of "real" background materials has been found at present, as these are mostly just under preparation by the relevant Project Teams and may be available in near future.

3. EN 1990 BASIS OF STRUCTURAL DESIGN

Materials prepared by Prof. Szczepan Wolinski (Rzeszow UT, Poland)
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General information

The text of European Standard EN 1990 was ratified by the CEN Technical Board in view of its implementation as national standards. Date of ratification: 2001-11-29 and the date of availability (DAV): 2002-04-24.

National variations preserved

It is the responsibility of each national standards body to implement Eurocodes as national standards. The national standard implementing EN 1990 should comprise the full text of the Eurocode and its annexes as published by the CEN, proceeded by a national title page and national foreword, and may be followed by a national annexes.

Possible differences in geographical or climatic conditions or in ways of life, as well as different levels of protection can be taken into account by choice values, classes or methods that are identified in the Eurocodes to be determined nationally (called "nationally determined parameters").

The national standards bodies should publish the parameters in a national annex on behalf of and with the agreement of the national competent authorities.

A national annex cannot change or modified the content of the EN Eurocode text in any way other than where it indicates that national choices may be made by means of nationally determined parameters.

Each EU member state will have a different national annex. The annex used must be the one applicable to where the civil engineering work is being constructed. A designer will have to use the appropriatte Eurocode with a national annex proper for each EU member state.

Content list

EN 1990: 2002 has the following sections:

- General sections, applicable to all structures within the fields of application of the structural Eurocodes, defining requirements and criteria:
  - Section 1: General
  - Section 2: Requirements
  - Section 3: Principles of limit states
  - Section 4: Basic variables
  - Section 5: Structural analysis and design assisted by testing
  - Section 6: Verification by the partial factor method
- Normative (N) and informative (I) annexes:
  - Annex A1 (N): Application for buildings
  - Annex B (I): Management of structural reliability for construction works
  - Annex C (I): Basis for partial factor design and reliability analysis
  - Annex D (I): Design assisted by testing
- Future annexes:
  - Annex A2 (N): Application for bridges
  - Annex A3 (N): Application for towers, masts and chimneys
  - Annex A4 (N): Application for silos and tanks
  - Annex A5 (N): Application for cranes and machinery
  - Annexes (I?): E1: Structural bearings, E2: Expansion joints, E3: Pedestrian parapets, E4: Vehicle parapets, E5: Ropes and cables
- National annex (N): the one applicable to where the building or civil engineering works is being constructed.

4. EN 1991 ACTION ON STRUCTURES

Materials prepared by Prof. Szczepan Wolinski (Rzeszow UT, Poland)
szwolkkb@prz.rzeszow.pl

General information

The text of the European Standard EN 1991 was ratified by CEN Technical Board in view of its implementation as national standards. Date of ratification: 2001–11–30, and the date of availability (DAV): April 2002.

Content list

EN 1991-1 General actions (DAV: April 2002)

EN 1991-1.1– Densities, self weights, imposed loads on buildings (DAV: March 2003)

EN 1991-1.2 – Actions on structures exposed to fire (missing)

EN 1991-1.3 – Snow loads (DAV: March 2003)

EN 1991-1.4 – Wind actions (DAV: March 2003)

EN 1991-1.5 – Thermal actions (DAV: January 2004)
EN 1991-1.6 – Actions during execution (DAV: January 2004)
EN 1991-1.7 – Accidental actions (DAV: March 2004)

Other:
EN 1991-2 Traffic loads on bridges (DAV: May 2004)
EN 1991-3 Actions due to cranes and machinery (DAV: September 2004)
EN 1991-4 Actions in silos and tanks (DAV: January 2004)

5. EN 1992 DESIGN OF CONCRETE STRUCTURES

Materials prepared by Prof. Aniko Csebfalvi (University of Pécs, Boszorkány u. 2., H-7624 Pécs, Hungary)
csebfalv@garfield.pmmf.hu

and by Prof. Andrej Lapko (Bialystok Technical University, 15-351 Bialystok, Poland)
lapko@cksr.ac.bialystok.pl

The first part: generic rules
(in May 2004 stage 49 - since 12/2003, formal vote was positively done in February 2004)

- EN 1992-1-1 Common rules for buildings and civil engineering structures.
- EN 1992-1-2 Structural fire design.

Remaining parts: specific types of structures
(in May 2004 stage 34)

- EN 1992-2 Bridges.
- EN 1992-3 Liquid retaining and containment structures.

6. EN 1993 DESIGN OF STEEL STRUCTURES

Materials prepared by Prof. Josef Machacek (Faculty of Civil Engineering, Czech Technical University, Thakurova 7, Prague, Czech Republic), parts 1993-1-1
Machacek@fsv.cvut.cz

and by Prof. Hynek Sertler (Faculty of Transport, University of Pardubice, Czech Republic), parts 1993-2 to 1993-6
hynek.sertler@upce.cz

Eurocode 3 is the most extensive Eurocode due to the diversity of steel elements, joints and structures and has 20 pieces. The work in preparing the Eurocode parts is governed by CEN/TC250/SC3, chaired by Prof. F. S. K. Bijlaard. The first part contents 12 pieces of generic rules, however, with one cancelled. Remaining 8 parts cover specific types of structures.

The first part: generic rules

		PT convenor
1993-1-1	General rules and rules for buildings	(J.B. Schleich)
1993-1-2	Structural fire design	(L. Twilt)
1993-1-3	Supplementary rules for cold formed members	(M. Heineso)
1993-1-4	Stainless steel	(B. Burgan)
1993-1-5	Plated structural elements	(B. Johansson)
1993-1-6	Strength and stability of shell structures	(M. Rotter)
1993-1-7	cancelled	
1993-1-8	Design of joints	(J.B. Schleich)
1993-1-9	Fatigue	(J.B. Schleich)
1993-1-10	Material toughness & through thickness properties	(J.B. Schleich)
1993-1-11	Design of structures with tension comp.	(G. Sedlacek)
1993-1-12	Additional rules for steel grades up to S700	(B. Johansson)

Remaining parts: specific types of structures

		PT convenor
1993-2	Steel bridges	(G. Sedlacek)
1993-3-1	Towers, masts and chimneys – Towers & masts	(B. Smith)
1993-3-2	Towers, masts and chimneys – Towers & masts	(B. Smith)
1993-4-1	Silos, tanks and pipelines – Silos	(R. Greiner)
1993-4-2	Silos, tanks and pipelines – Tanks	(H. Saal)
1993-4-3	Silos, tanks and pipelines – Pipelines	(N. Gresnigt)
1993-5	Piling	(A. Schmitt)
1993-6	Crane supporting structures	(C. Taylor)

There will be 6 packages released for the particular type of design:
Building, bridges, towers, silos, piling, cranes.

EN 1993-1-1 Design of steel structures – General rules and rules for buildings

Short overview:

- ENV 1993-1-1 approved in 1992.
- May 2004: stage 49 (since 9/2003, soon DAV, PT convenor J.B. Schleich)
- EN contains rules for material properties, durability, structural analysis (incl. imperfections), structural stability and cross-sectional resistance.

EN 1993-1-5 Design of steel structures - Plated structural elements

Short overview:

- ENV 1993-1-5 approved in 1997.
- May 2004: stage 34 (since 9/2003, soon DAV, PT convenor B. Johansson)
- The EN replaces ENV 1993-1-5 General rules – Supplementary rules for planar plated structures without transverse loading, approved in 1977. While ENV 1993-1-5 provided alternatives to ENV 1993-1-1 for design of class 4 cross sections and other buckling assessments concerning both unstiffened and stiffened plates, in the ENs all buckling procedures (due to direct stresses, shear stresses, local stresses) are covered by EN 1993-1-5 only.

EN 1993-1-9 Design of steel structures - Fatigue

Short overview:

- New standard.
- May 2004: stage 49 (since 9/2003, soon DAV, PT convenor J.B. Schleich)
- EN contains rules for assessment of fatigue resistance of members, connections and joints subjected to fatigue loading.

EN 1993-1-10 Design of steel structures – Material toughness and through-thickness properties

Short overview:

- New standard.
- May 2004: stage 49 (since 9/2003, soon DAV, PT convenor J.B. Schleich)
- EN contains design guidance for the selection of steel for fracture toughness and for through thickness properties of welded elements where is a significant risk of lamellar tearing during fabrication.

EN 1993-1-12 Design of steel structures - Additional rules for the extension of EN 1993 up to steel grades S700

Short overview:

- New standard.
- May 2004: stage 32 (since 3/2004, PT convenor B. Johansson)
- EN extends the scope of EN 1993 and EN 1090 to include steel grades up to and including S690.

7. EN 1994 DESIGN OF COMPOSITE STEEL AND CONCRETE STRUCTURES

Materials prepared by Prof. Luís Calado (Instituto Superior Técnico, Department of Civil Engineering and Architecture, Av. Rovisco Pais, 1049-001 Lisboa, Portugal)
calado@civil.ist.utl.pt

CEN/TC250/SC4 Eurocodes

- prEN 1994 - Design of composite steel and composite structures, Part 1.1 – General rules and rules for buildings (May 2003, in May 2004 stage 49)

- prEN 1994-1-2 - Design of composite steel and composite structures, Part 1.2 – General rules – Structural fire design (May 2003, in May 2004 stage 34)

- prEN 1994-2 - Design of composite steel and composite structures, Part 2 – Rules for bridges (February 2003, in May 2004 stage 34)

Lectures on Composite Structures (SC4)

- *ESDEP – European Steel Design Education Programme,* 1994, Working Group 10, Composite Construction.

- *Structural Steelwork Eurocodes – Development of a Transnational Approach (SSEDTA)*
http://fp.emberey.plus.com

CEN/TC250/SC4 documents

- N191 ECCS evaluation of existing tests, 1998 – 106.
- N239 background to prEN 1994-1-1 (03-01-2002)

8. EN 1995 DESIGN OF TIMBER STRUCTURES

Materials prepared by Prof. Ivan Totev (University of Architecture, CivilEngineering & Geodesy, 1 Chr. Smirnenski Blvd., 1046 Sofia, Bulgaria)
itotev_fce@uacg.bg

The first part: generic rules
EN 1995-1-1 Common rules and rules for buildings
(In May 2004 stage 49 - since 9/2003, soon DAV)
EN 1995-1-2 Structural fire design
(In May 2004 stage 49 - since 9/2003, soon DAV)

Other part:
EN 1995-2 Bridges
(In May 2004 stage 34)

9. EN 1996 DESIGN OF MASONRY STRUCTURES

Materials prepared by Prof. Andrej Lapko (Bialystok Technical University, 15-351 Bialystok, Poland)
lapko@cksr.ac.bialystok.pl

Eurocode 6 consists of four parts (in May 2004 all in stage 34):
The first part: general rules
EN 1996-1-1 Rules for reinforced and unreinforced masonry sructures.
EN 1996-1-2 Structural fire design.

Other parts:
EN 1996-2 Selection of materials and execution of masonry.
EN 1996-3 Simplified calculation methods and simple rules for masonry structures.

10. EN 1997 GEOTECHNICAL DESIGN

Materials prepared by Prof. Roger Frank (CERMES, ENPC-LCPC)
frank@cermes.enpc.fr,

and byProf. Richard Kastner (INSA de Lyon)
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ABSTRACT: Eurocode 7 consists of two Parts: "General rules" and "Ground investigation and testing". Their conversion from pre-standards (ENVs) to full European Norms (ENs) is now nearly completed (April 2004). Part 1 has been voted positively and Part 2 is technically stabilised. After a historical note and a list of the forthcoming deadlines, the main features and contents of the two ENs for Eurocode 7 are given and some aspects of particular interest are described (characteristic values, ULS verifications in persistent and transient design situations).

Introduction

Eurocode 7 on Geotechnical Design originally consisted of three parts. Thus, three pre-standards (ENVs) were published:
ENV 1997-1 Part 1: General Rules (1994)
ENV 1997-2 Part 2: Design assisted by laboratory testing (1999)
ENV 1997-3 Part 3: Design assisted by field testing (1999).
The documents for Parts 2 and 3 are now being merged into one single document (for the conversion into EN) which is called «Part 2: Ground investigation and testing ».
The recent development of Eurocode 7 was linked strongly to the development of EN 1990: "Eurocode: Basis of structural design" which is available since 2002.

Brief history

The first Eurocode 7 Group, was created in 1981 and was composed of representatives of the National Societies for Geotechnical Engineering of the countries forming the European Community. In 1987 a first model code on general rules for geotechnical design (corresponding to Eurocode 7-Part 1) was drafted and published in 1990.

In 1989, the task of drafting design codes for buildings and civil engineering works was transferred to the Comité Européen de Normalisation (CEN, European Committee for Standardization) and CEN/TC 250 in charge of all the ‘Structural Eurocodes’ was created. In particular, SC 7, Sub-Committee 7, is in charge of Eurocode 7 on ‘Geotechnical Design’. N. Krebs Ovesen was the first Chairman of CEN/TC 250/SC 7 until 1998. Since 1998, Roger Frank is Chairman of SC 7.

In 1993, SC 7 adopted the ENV 1997-1 pre-standard: ‘Geotechnical Design. Part 1: General Rules’. It was clear, at that time, that (much) more work still needed to be done before reaching a full European standard (EN) acceptable to all member countries of CEN, considering that geotechnical design is unique and cannot be considered to be the same as other design practices needed in the construction industry. The methods commonly used vary from one country to the other and cannot be harmonised easily, simply because the geologies are different and form the rationale for the so-called ‘local traditions'…In September 1996, CEN/TC 250 accepted the principle that ENV 1997-1 might be devoted exclusively to the fundamental rules of geotechnical design and be supplemented by national standards, and an official positive vote for the conversion into an EN was obtained in May 1997. The work for the conversion of ENV 1997-1 into EN 1997-1 'Geotechnical Design. Part 1: General Rules' is now completed and the vote on the English, French and German versions was launched in January 2004. The result is a nearly unanimous positive vote (26 countries out of 28 expressed a positive vote).

Part 2 (EN 1997-2): "Geotechnical Design. Part 2: Ground investigation and testing" is now technically stabilised and an advanced draft in English has been produced.

Forthcoming deadlines

After the positive vote for Part 1, the 3 documents will be made available by CEN before the end of 2004. The publication of the corresponding European Norm by each national standardisation body with its National Annex will have to be completed within two years. Then will start the so-called 'coexistence period' (with other national standards).

The final editing of Part 2 and the translations into French and German should be completed during 2004 in order to go to formal vote.

Content of documents

Part 1: General rules

Eurocode 7 - Part 1 is a rather general document giving only the principles for geotechnical design inside the general framework of LSD. These principles are relevant to the calculation of the geotechnical actions on structures and to the design of the structural elements in contact with the ground. Detailed design rules are only given in informative Annexes. The main reason is that the design methods in geotechnical engineering differ from one country to the other.

The document prepared for Eurocode 7–Part 1, includes the following sections:

section	Title	section	Title
1	General	7	Pile foundations
2	Basis of geotechnical design	8	Anchorages
3	Geotechnical data	9	Retaining structures
4	Supervision of construction, monitoring and maintenance	10	Hydraulic failure
5	Fill, dewatering, ground improvement and reinforcement	11	Site stability
6	Spread foundations	12	Embankments

The list of the Annexes for EN 1997-1 is the following:

Annex	Title	Annex	Title
A	Partial factors for ultimate limit states	F	Sample methods for settlement evaluation

B	Background information on partial factors for Design Approaches 1, 2 3	G	A sample method for deriving presumed bearing resistance for spread foundations on rock
C	Sample procedures to determine limit values of earth pressures on vertical walls	H	Limiting foundation movements and structural deformation
D	A sample analytical method for bearing resistance calculation	J	Checklist for construction super-vision and performance monitoring
E	A sample semi-empirical method for bearing resistance estimation		

Part 2: Ground investigation and testing

The role of this part of Eurocode 7 devoted to laboratory and field testing is to give the essential requirements for the equipment and test procedures, for the reporting and the presentation of results, for their interpretation and, finally, for the derivation of values of geotechnical parameters for the design. It will not cover the standardisation of the geotechnical tests themselves.

The draft for EN 1997-2 includes the following Sections:

Section	Title	Section	Title
1	General	4	Field tests in soils and rocks
2	Planning of ground investigations	5	Laboratory tests on soils and rocks
3	Soil and rock sampling and groundwater measurements	6	Ground investigation report

Some specific aspects of Eurocode 7

Verification procedures

In Eurocode 7, it should be stressed that calculations are not the only means for checking that the basic requirements are fulfilled and that various possibilities are offered. Limit states should be verified by one or a combination of the following:

- use of calculations […];
- adoption of prescriptive measures, […];
- experimental models and load tests, […];
- an observational method, […].'

Eurocode 7 – Part 1 also mentions that: that knowledge of the ground conditions and the control of workmanship are usually more significant to fulfilling the fundamental requirements than is precision in the calculation models and partial factors.

Characteristic values

The present 'philosophy' with regard to the definition of characteristic values of geotechnical parameters is contained in clause 2.4.5.2 of the present draft for Eurocode 7–Part 1:

'(2)P The characteristic value of a geotechnical parameter shall be selected as a cautious estimate of the value affecting the occurrence of the limit state.'

'(7) […] the governing parameter is often the mean of a range of values covering a large surface or volume of the ground. The characteristic value should be a cautious estimate of this mean value.'

Statistical methods are mentioned only as a possibility:

'(11) If statistical methods are used, the characteristic value should be derived such that the calculated probability of a worse value governing the occurrence of the limit state under consideration is not greater than 5%.'

This comes from the general feeling that for the majority of projects, the geotechnical investigation is such that no serious statistical treatment of the data can be performed. Statistical methods are, of course, useful for very large projects where the amount of data justifies them.

ULS verifications in persistent and transient design situations

According to Eurocode 7 – Part 1, five ultimate limit states (ULS) to be checked are defined, in the following manner, consistently with 'Eurocode: Basis of structural design' :

'P Where relevant, it shall be verified that the following limit states are not exceeded:

- loss of equilibrium of the structure or the ground, considered as a rigid body…(EQU);
- internal failure or excessive deformation of the structure or structural elements…(STR);
- failure or excessive deformation of the ground …(GEO);
- loss of equilibrium of the structure or the ground due to uplift by water pressure …(UPL);
- hydraulic heave, internal erosion and piping in the ground caused by hydraulic gradients (HYD).

Concerning the design approaches, after a long debate, the consensus reached with TC 250 in charge of drafting 'Eurocode: Basis of structural design' (EN1990) and inside TC 250 /SC 7 itself, opened the way to three different Design Approaches. The choice is left to national determination, i.e. each country will have to choose, in the near future, the Design Approach(es) to be used for each type of geotechnical structure (spread foundations, pile foundations, retaining structures, slope stability).

Liaisons

Inside the Eurocode system itself, there are, of course, many links between the different standards and Eurocode 7 is more precisely linked to the following ones:

- EN 1990: 'Eurocode: Basis of structural design'
- ENV 1998-5: Design of structures for earthquake resistance.

The other Technical Committees of CEN working on standards of interest for Eurocode 7, and for which coordination must be ensured are:

CEN/TC 341 on 'Geotechnical investigation and testing', as mentioned earlier;

CEN/TC 288 on 'Execution of geotechnical works';

CEN/TC 189 on 'Geotextiles and geotextile-related products';

CEN/TC 227 on 'Road materials'.

With regard to ISO, a strong liaison is kept with ISO/TC 182 on 'Geotechnics', especially:

ISO/TC 182/SC 1 Geotechnical investigation and testing;

ISO/TC 182/SC 3 Foundations, retaining structures and earthworks.

Concluding remarks

The work for the elaboration of a common framework for geotechnical design throughout Europe, i.e. Eurocode 7, started some 25 years ago. The corresponding standards/codes will be available soon.

Whatever the future status of Eurocode 7 in the various countries, it will prove to be very important for the whole construction industry. It is meant to be a tool to help European geotechnical engineers speak the same technical language and also a necessary tool for dialogue between geotechnical engineers and structural engineers.

Eurocode 7 helps promote research. Obviously, it stimulates questions on present geotechnical practice from ground investigation to design models. It is our belief that it will also be very useful to many geotechnical and structural engineers all over the world, not only in Europe.

11. EN 1998 DESIGN PROVISIONS FOR EARTHQUAKE RESISTANCE OF STRUCTURES

Materials prepared by Prof. Rafael Blazquez
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EN 1998 consists of 6 parts as follows:

EN 1998-1	General rules, seismic actions and rules for buildings (in May 2004 stage 49 - since 11/2003, soon DAV)
EN 1998-2	Bridges (in May 2004 stage 34)
EN 1998-3	Strengthening and repair of buildings (in May 2004 stage 34)
EN 1998-4	Silos, tanks and pipelines (in May 2004 stage 34)
EN 1998-5	Foundations, retaining structures and geotechnical aspects (in May 2004 stage 49 - since 11/2003, soon DAV)

EN 1998-6 Towers, masts, chimneys
(in May 2004 stage 34)

12. EN 1999 DESIGN OF ALUMINIUM ALLOY STRUCTURES

Materials prepared by Prof. Josef Machacek (Faculty of Civil Engineering, Czech Technical University, Thakurova 7, Prague, Czech Republic)
Machacek@fsv.cvut.cz

Initially 3 parts covering common rules, structural fire design and structures susceptible to fatigue were planned by CEN. Final Eurocode has 5 parts as follows (in May 2004 all in stage 34):

EN 1999-1-1 General structural rules
EN 1999-1-2 Structural fire design
EN 1998-1-3 Structure susceptible to fatigue
EN 1998-1-4 Supplementary rules for cold-formed sheeting
EN 1998-1-5 Supplementary rules for shell structures

There are two packages envisaged:
Package 9/1 All without fatigue.
Package 9/2 With fatigue.

EN 1999-1-1 General structural rules

Short overview:

- ENV 1999-1-1 approved in 1998.
- April 2004: stage 34 (since 10/2003, during 2004 stage 49)
- EN contains rules for material properties, durability, structural analysis, limit states, connections.

Annex

BACKGROUND MATERIALS

EN 1990 BASIS OF STRUCTURAL DESIGN

Commision Européenne / Direction Generale Enterprises – Guidance Paper L: Application and Use of Eurocodes, January 2002.
Key chapters: all chapters of EN 1990

Background Document Eurocode 1, Part 1: Basis of Design, JCSS Working Document, ECCS Publication 94, March 1996.
Key chapters: all chapters of EN 1990

International Standard ISO 2394: 1998(E), General principles on reliability for structures. Second edition, 1998-06-01.
Key chapters: all chapters of EN 1990

Gulvanessian, H. – Calgaro, J-A. – Holicky M.: Designrs' Guide to EN 1990 Eurocode: Basis of structural design. Thomas Telford Ldt, London, 2002.
Key chapters: all chapters of EN 1990

Sedlacek, G., et. al.: Relationship between Eurocode 1 and the "material" oriented Eurocodes. IABSE Colloquium: Basis of Design and Actions on Structures. Delft, 1996.
Key chapters: principles of limit states, basic variables, verification by the partial factor method

Hietanen, T.: Proposal for material safety factors. CEN TC 250 / S.C. 2 – N 331. Draft background document for informative Annex A of EN 1992 – 1, July 2001.
Key chapters: basic variables, verification by partial factor method

Taerve, L.: Survey and background of the semiprobabilistic design method for concrete structures according to Eurocodes EC1 and EC2. Studi e Ricerche, Politechnico di Milano, Vol.17, 1996, pp. 351 – 389.
Key chapters:requirements, basic variables, verification by the partial factor method, basis for partial factor design and reliability analysis

Östlund, L.: Actions. IABSE Colloquium: Basis of Design and Action on Structures. Background and Applications of Eurocode 1. IABSE Reports, Vol. 74, Delft, February 1996, pp.51 – 57.
Key chapters: basic variables, actions and environmental influences

Faber, M.H. – Sørensen, J.D.: Reliability based code calibration – The JCSS Approach. Proceedings of the 9th International Conference on Application of Statistics and Probability, San Francisco, 2003.

Key chapters: reqiurements, management of structural reliability for construction works, basis for partial factor design and reliability

The Joint Committee on Structural Safety: A first version of Model Code 2002. The JCSS Internet Site: *http://www.iabse.ethz.ch/lc/jcss.html.*
Key chapters: general reqiurements, actions and environmental influences, material and product properties, geometrical data, management of structural reliability for construction works

Calgaro, J.A. – Gulvanessian, H.: Management of Reliability and Risk in the Eurocode System. International Conference Malta 2001: Safety, Risk and Reliability – Trends in Engineering. Conference Report, pp. 155 – 160.
Key chapters: all chapters of EN 1990
NKB: Basis for Design of Structures. Proposal for Modification of Partial Safety Factors in Eurocodes. NKB Committee and Work Reports, 1990:01E, Oslo 2002.
Key chapters: all chapters of EN 1990

More important textbooks

Blockley, D.I.: The nature of structural design and safety. Halsted Press, John Wiley&Sons Inc., New York,1980.
Key chapters: all chapters of EN 1990

Nowak, A.S. – Collins, K.R.: Reliability of Structures. McGraw – Hill Int.Editions, 2000.
Key chapters: all chapters of EN 1990

Ditlevsen, O.: Structural Reliability Methods. John Wiley&Sons Inc., New York, 1996.
Key chapters: all chapters of EN 1990

Haldar, A. – Mahadevan, S.: Probability, Reliability and Statistical Methods in Engineering Design. John Wiley&Sons Inc., New York, 2000.
Key chapters: all chapters of EN 1990

Thoft – Christen, P. – Baker, M.J.: Structural reliability and its applications. Springer – Verlag, Berlin – Heilderberg – New York,1982.
Key chapters: all chapters of EN 1990

Software

In order to perform a reliability analysis or/and probability-based design of structural elements and structures, additional calculation tools are useful. A few examples of computer programs are given in this chapter.

NESSUS: a modular computer software system for performing probabilistic analysis of structural components and systems. Uncertainties in loading, material properties, geometry, boundary conditions and initial conditions can be simulated.
Developer and distributor: Southwest Research Institute, USA
Information: http://nessus.swri.org/index.shtml

COSSAN: a general purpose software package for structural analysis taking into account the statistical uncertainties of various material, loading and geometric parameters.
Developer and distributor: Institut of Engineering Mechanics, LFU, Innsbruck, Austria
Information:http://www.uibk.ac.at./c/c8/c810/SoftwareDevelopment/Cossan/index.html

RELACS: evaluates probabilities of certain events defined in terms of random variables and smooth limit state functions.
Developer and distributor: Risk Engineering, Inc. USA
Information: http://www.riskeng.com/SoftwareHTML/software_relacs.html

EN 1991 ACTION ON STRUCTURES

EN 1991-1 General actions

Commision Européenne / Direction Generale Enterprises – Guidance Paper L: Application and Use of Eurocodes, January 2002.
Key chapters: all chapters of EN 1991-1

International Standard ISO 2394: 1998(E), General principles on reliability for structures. Second edition, 1998-06-01.
Key chapters: all chapters of EN 1991-1

NKB: Guidelines for Loading and Safety Regulations in Structural Design. NKB Report No.55E, June 1999.
Key chapters: all chapters of EN 1991-1

Sedlacek, G., et. al.: Relationship between Eurocode 1 and the"material" oriented Eurocodes. IABSE Colloquium: Basis of Design and Actions on Structures. Delft, 1996.
Key chapter: all chapters of EN 1991-1

Östlund, L.: Actions. IABSE Colloquium: Basis of Design and Action on Structures. Background and Applications of Eurocode 1. IABSE Reports, Vol. 74, Delft, February 1996, pp.51 – 57.
Key chapters: general actions and environmental influences

The Joint Committee on Structural Safety: A first version of Model Code 2002. The JCSS Internet Site: *http://www.iabse.ethz.ch/lc/jcss.html.*
Key chapters: general actions and environmental influences

CIB W81: Actions on structures. CIB Reports No.: 115, 116, 141, 166, 167, 193, 194, 195. CIB, Rotterdam, 1996.
Key chapters: all parts and chapters of EN 1991

The Joint Committee on Structural Safety: Basic Notes of Actions. CEB Bulletine d'Information, No. 112, July 1996.

Key chapters: all parts and chapters of EN 1991

Turkstra, C.J., Madsen, H.O.: Load Combination in Codified Structural Design. Journal of the Structures Divison ASCE, Vol. 106, No. 12, 1980, pp. 2527–2543.
Key chapters: general actions, load combination

Chalk, L.P., Corotis, R.B.: Probability Models for Design Live Loads. Journal of Structures Division ASCE, Vol. 106, No. 10, 1980, pp. 2017–2033.
Key chapter : general actions, live loads, load combination

Wen, Y.K.: Structural Load Modeling and Combination for Performance and Safety Evaluation. Elsevier, Amsterdam, 1990.
Key chapters: general actions, load combination

Floris, C.: Stochastic analysis of load combination. Journal of Engineering Mechanics, ASCE, September 1998.
Key chapters: general actions, load combination

EN 1991-1.1 Densities, self weight, imposed loads on buildings

Sentler, L.: Live Load Survey in Domestic Houses. Division of Building Technology, Lund Institute of Technology, Lund 1974.
Key chapters: imposed loads on buildings

Sentler, L.: Live Load Survey in Office Buildings and Hotels. Division of Building Technology, Lund Institute of Technology, Lund 1974.
Key chapters: imposed loads on buildings

Borges, J. – Ferry, M. – Castanheta, M.: Structural Safety, Course 101. Laboratorio Nacional de Engenharia Civil, 2nd Edition, Lisbon, 1971.
Key chapters: imposed loads on buildings

Mitchell, G.R. – Woodgate, R.W.: Floor Loadings in Office Buildings – The Results of a Survey. Building Research Station. Current Paper 3/71, London, January 1971.
Key chapters: imposed loads on buildings

Mitchell, G.R. – Woodgate, R.W.: Floor Loadings in Retail Premisses – The Results of a Survey. Building Research Station. Current Paper 25/71, London, September 1971.
Key chapters: imposed loads on buildings

Ellingwood, B. – MacGregor, J.G. – Galambos, T.V. – Cornell, C.A.: Probability Based Load Criteria: Load Factors and Load Combinations. Journal of the Structural Division (ASCE) 108, No. ST5, 1980, pp. 978-997.
Key chapters: all chapters of EN 1991-1.1

Nowak, A.S. – Collins, K.R.: Reliability of Structures. McGraw-Hill Int. Edition, 2000
Key chapters: all chapters of EN 1991-1.1

CIB W81: Actions on structures. CIB Reports No.: 115, 116, 141. CIB, Rotterdam, 1996.
Key chapters: all chapters of EN 1991-1.1

EN 1991-1.2 Actions on structures exposed to fire

ISO 834: Fire Resistance – General Requirements. Zurich,1997.
Key chapters: all chapters of EN 1991-1.2

CIB: Action on Structures – Fire. CIB Report, Publication No.166, 1993.
Key chapters: all chapters of EN 1991-1.1

EN 1991-1.3 Snow loads

Sanpaolesi, L. – et. al.: New European Code for Snow Loads. Background documents. University of Pisa, Department of Structural Engineering, Proceedings No. 264, Pisa, 1995.
Key chapters: all chapters of EN 1991-1.3

Isyumow, N. – Davenport, A.G.: A Probabilistic Approach to the Prediction of Snow Loads. Canadian Journal of Civil Engineering, Vol.1, No. 1, September 1974.
Key chapters: all chapters of EN 1991-1.3

Ellingwood, B. – Redfild, R.: Ground Snow Loads for Structural Design. Journal of Structural Engineering, Vol. 109, No. 4, 1983, pp. 291-299.
Key chapters: all chapters of EN 1991-1.3

JCSS: Snow load. Basic Notes on Actions. A-06. April 1984.
Key chapters: all chapters of EN 1991-1.3

EN 1991-1.4 Wind loads

Davenport, A.G.: Structural Safety and Reliability under Wind Action. International Conference on Structural Safety and Reliability. Wshington, D.C. April 1969. Pergamon Press, Oxford 1972, pp. 131-145.
Key chapters: all chapters of EN 1991-1.4

Borges, J. – Ferry M. – Castanheta, M.: Directional Effects of Wind. Laboratorio Nacional de Engenharia Civil, Lisbon, June 1976.
Key chapters: directional effects of wind

Borges, J. – Ferry M. – Castanheta, M.: Wind in Western Europe. Results of an Enquiry. Laboratorio Nacional de Engenheria Civil. Lisbon, February 1972.
Key chapters: basic wind speeds for West Europe

Simiu, E. – Scanlan, R.H.: Wind Effects on Structure. Wiley&Son, New York, 1978.
Key chapters: all chapters of EN 1991-1.4

Koten, H., van: Wind Measurements of High Buildings in the Netherlands. Proceedings of the International Research Seminar on Wind Effects on Buildings and Structures. Ottawa, September 1967.
Key chapters: wind pressure on high buildings

Ellingwood, B. – Tekie, B.P.: Wind Load Statistics for Probability-Based Structural Design. Journal of Structural Engineering (ASCE), Vol. 125, No. 4, 1999, pp. 453-463.
Key chapters: all chapters of EN 1991-1.4

EN 1991-1.5 Thermal actions
No background materials available.

EN 1991-1.6 Actions during execution

Xilia, L. – Chen, W.F. – Browman, M.D.: Construction loads analysis for concrete structures. Journal of Structural Engineering (ASCE), Vol. 111, No. 5, May 1985, pp. 1019-1036.
Key chapters: actions during execution of concrete structures

Rosovsky, D.V. – Philbrick, T.W. – Huston, D.: Observations From Shore Load Measurement During Concrete Construction. Journal of Performance of Constructed Facilities, February 1997, pp. 18-23.
Key chapters: actions during execution of concrete structures

EN 1991-1.7 Accidental actions

Background documentation of ENV 1991-1.7: Accidental actions. 1996, 44 pp.
Key chapters: all chapters of EN 1991-1.7

Mayne, J.R.: The Estimation of Extreme Winds. J. of Industrial Aerodynamics. Vol. 4, 1979.
Key chapters: extreme winds

Cho, N.H. – Lee, S.J.: Reliability-Based Design of Transmission Tower under Wind and Ice Loading. Structural Engineering in Natural Hazards Mitigation. Eds. A.H.S.Ang and R. Villaverded, Vol. 2, 1993, pp. 1125-1130.
Key chapters: wind and ice loading

Ahlenius, E.: Uncertainties of explosion loads and its influence on reliability. IABSE Colloquium “Structures for the future”. Rio de Janeiro, 1999.
Key chapters: explosion loads

Fajfar, P. – Krawinkler, H. (editors): Seismic design methodologies for the next generation of codes. AA Balkena, Rotterdam, 1997.
Key chapters: seismic and pseudo-seismic loads

Larsen, D.: Ship Collision with Bridges. IABSE, Switzerland, Zurich, 1993.
Key chapters: impact load

International Union of Railways: Safety Assessment for Components of Risk from Impact. Developments with Superstructures. Ernst Basler & Partners Ldt., 1996.
Key chapters: impact load

Murzewski , J.: Reliability of Building Structures. Arkady, Warszawa, 1989 (in Polish).
Key chapters: all chapters of EN 1991-1.7

EN 1991-2 Trafic loads on bridges

JCSS: Trafic loads. Basic Notes on Actions A-03. April 1984.
Key chapters: all chapters of EN 1991-2

Nowak, A.S. – Collins, K.R.: Reliability of Structures. McGraw Int. Edition, 2000.
Key chapters: all chapters of EN 1991-2

Oestlund, L. – Sundquist, H.: Calibration of Traffic Design Loads for Long-Span Bridges. Int. Conference on Safety, Risk and Reliability. Malta, March 2001, pp. 173-178.
Key chapters: traffic loads for long-span bridges

Nowak, A.S. – Czernecki, J., - Zhou, J. – Kayser, R.: Design Loads for Future Bridges. FHWA Project, Report UMCE 87-1, University of Michigen, Ann Arbor, 1987.
Key chapters: all chapters of EN 1991-2

EN 1991-3 Actions due to crane and machinery
No background materials available.

EN 1991-4 Actions in silos and tanks
Martens, P.: Silo Handbuch. Wilhelm Ernst & Sohn Verlag fur Architektur und Technische Wissenschaften, Berlin, 1989.
Key chapters: all chapters of EN 1991-4 concerning silos

Blight, G.E.: Temperature induced loading on silo walls, Structural Engineering Review, Vol. 4(1), 1992, pp. 61 – 71.
Key chapters: thermal actuion on silos acc. to of EN 1991-4

Nielsen, J. - Eibl, J. - Rotter, M.: EC 1: Silos and Tanks. Proceedings of IABSE Symposium on Eurocodes. Switzerland, 1992, pp. 97 – 103.
Key chapters: all chapters of EN 1991-4

Jenkyn, R. T.: How to calculate Thermal Loading in Silos. Bulk Solids Handling. No 2, April/June 1994, pp. 345 – 349.
Key chapters: thermal actions in silo acc. to of EN 1991-4

Roberts, A. W.: Shock loads in silos due to flow pulsations. Proc. of the 3rd European Symposium on Storage and Flow of particulate Solid, Nurnberg, 1995, pp. 131 – 141.

Key chapters: chapters on pattern flow in silo

Schultze, D.: Silo Design and bulk solid properties. Proc. of International Conference on Powder and Bulk Solid Handling, London, 2000, pp. 97 – 108.
Key chapters: all chapters of EN 1991-4

Waters, A. J.: Drescher A.: Modelling plug flow in bins / hoppers. Powder Technology Elsevier Science. 113, 2000, pp. 169 – 175.
Key chapters: chapters on flow pattern in silo bins and hoppers

Safarian, S.S.: Empirical method for computing bending moments in circular silo walls due to assymetric flow considering flow channel concept. Bulk Solid Handling. Vol. 21, No 3/4 2001, s. 153 – 155.
Key chapters: chapters on actions due to eccentric flow in silo

Lapko, A. - Prusiel, J.: Experimental and theoretical analysis of thermal effects in full - scale grain silo battery. Proc. of 5 th International Congress „Thermal stresses 2003" , Blacksburg, Virginia, USA, 8 – 11 June, 2003, pp. Vol. 1., pp. MM2-1-1 – MM2-1-4.
Key chapters: chapters concerning static analysis of grouped circular silo

Lapko, A. - Gnatowski, M. - Prusiel, J.: Analysis of some effects caused by interaction between bulk solid and r c silo wall structure. Powder Technology Journal. Elsevier Science B. V., 133, 2003, pp. 44 – 53.
Key chapters: chapters concerning patch actions as well as thermal action sin silo

EN 1992 DESIGN OF CONCRETE STRUCTURES

Kordina K at al. Bemessunghilfmittel zu Eurocode 2. Teil 1 ENV 1992. Plannung von Stahlbeton-und Spannbetontragwerken. DafSt, Heft 425, Berlin 1992.
Key chapters: Design of reinforced concrete and prestressed concrete members

Litzner H.U.: Design of Concrete Structures to ENV1992 – Eurocode 2. In Concrete Structures Euro-Design Handbook 1994/1996. Ernst & Sohn, Berlin, 1995: pp. 138 – 308.
Key chapters: General methods of reinforced concrete structures design

Quast U.: Dimensioning of slender elements related to ultimate limit states influenced by structural deformations – stability check. In Concrete Structures Euro-Design Handbook 1994/1996. Ernst & Sohn, Berlin, 1995, pp. 138 – 308.
Key chapters: design of reinforced concrete columns.

Mosley W. H., Hulse R., Bungey J.H.: Reinforced Concrete Design to Eurocode 2. McMillan UK, Dec. 1996, pp. 426.
Key chapters: General rules. Part EN-1992-1-1

Lapko A.: Mechanics and design of reinforced concrete members in the light of Eurocode 2. Published by University da Beira Interior. Portugal, 1996, pp.295

Key chapters: structural analysis and design of structural concrete members.

Pieper D and werkle H.: Dictionary. “structural Engineering using Eurocode 2”. Fachhochschule Konstanz. 1997 (version in German – ed. 2003).
Key chapters: Dictionary – notations and definitions of EC-2.

Graubner C, A., Kupfer H, Rossner W.: Bemessungbeispiele nach Eurocode 2. Wiley-Europe, July 1997, pp.100.
Key chapters: Design of structural concrete

Tarig A., Burley E., Rigden St.: Bearing capacity of plain and reinferced concrete loaded over a limited area. ACI Structural Journal. May – June, 1998.
Key chapters: Design of structural members for local compression

Structural concrete. Textbook on Behaviour, Design and Performance. Updated knowledge of the CEB/FIP Model Code 1990, Vol.1 – 3, July 1999.

FIP Practical design of structural concrete (FIP Commission 3 on Practical design), Sept. 1999.
Key chapters: Design of reinforced concrete and prestressed concrete members.

Moss R.: Early age acceptance of concrete (improved quality management). Publ. BRE. 2000.
Key chapters: Properties of concrete in early age.

Fib Bulletin 12.: Punching of structural concrete slabs. International Federation for Structural Concrete. April 2001.
Key chapters: Design of reinforced concrete slabs for punching.

Challenges of Concrete construction. Edited by R.K. Dhir, University of Dundee. 2002, pp. 392.
Key chapters: Design of reinforced concrete and prestressed concrete members.

Narayanan R. S.: EN 1992 Eurocode 2: Design of concrete Structures. Civil Engineering Journal.
Institution of Civil Engineers. 2001.
Key chapters: General rules. Part EN-1992-1-1

Beispiele zur Bemessung nach DIN 1045-1. Bd.2: Ingenieurbau.: 2003.
Key chapters: Examples of design of structural concrete acc. to DIN and EN-1991-1-1.
Beeby A and Narayanan R.: Designers’ Guide to EN 1992-1-1. Eurocodes Expert Ed. To be publish in Oct. 2004.
Key chapters: General rules. Part EN-1992-1-1

Kennedy Reid I and Hendy C.: Design of concrete structures. Bridges. Eurocodes Expert Ed. To be publish in Jan. 2005.
Key chapters: Part EN-1992-2

Software for design using EC-2:

EC-2 – Tools Ver.3.1
Designer Tools to Eurocode 2 Part 1 and DIN 1045-1. Design of Concrete Structures
Key chapters: Numerical design of structural concrete members (slabs, beams, columns, footings, retaining walls, corbels and deep beams)
Design aids for academics and structural designers:
(Initiativ of Reinforced Concrete Council in UK)
http://www.eurocode2.info/EC2wphome.htm

This site is intended to help with the transition to Eurocode 2 by keeping all those involved in the design of concrete structures informed of developments in:
Eurocodes - the design Euronorms - in general,
Eurocode 2 - concrete design - including design and educational aids.
In order to help comprehension of EC2 a number of **preliminary** guidance notes have been produced viz:

- Practical guidance [Practical use of Eurocode 2]
- EC2 vs BS 8110 [EC2 vs BS8110]
- How to design leaflets
  - Beams [How to design … beams to EC2]
  - Solid slabs [How to design … solid slabs to EC2]
  - Columns & walls [How to design … columns & walls to EC2]
  - Flat slabs [How to design … flat slabs to EC2]
  - Deflections [Guidance]

- Design flowcharts [EC2 flowcharts3]
- Design equations [Basic equations]
- Cover & concrete quality [Guide to cover and quality]
- Materials generally See *Euronorms*
- UK Regs. Guidance [Annex 3 - Prov. Reg System for UK]
- Design spreadsheets due 2003/4, see http://www.rcc-info.org/

English books
Introduction to Eurocode 2: Design of Concrete Structures (Including Seismic Actions); Beckett, Alexandrou; 1998
Design AIDS for Ec2: Design of Concrete Structures: Design AIDS for Env 1992-1-1 Eurocode 2; 1997
Reinforced Concrete Design to Eurocode 2; Mosley, Hulse, Bungey; 1996
Designers' handbook to Eurocode 2: Part 1.1: Design of concrete structures; Beeby, Narayanan; 1995
Concrete Structures: Eurocode EC2 & BS 8110 Compared; Narayanan, Warner; 1994
Concrete Structures Euro-Design Handbook 94/96; 1994
CEB-FIP Model Code 1990; 1993
these and other english books see at: amazon.com, palgrave.com, t-telford.co.uk

German books

Beispiele zur Bemessung nach DIN 1045-1. Bd. 2: Ingenieurbau.; 2003
Stahlbetonbau aktuell 2003 / Mauerwerksbau aktuell 2003. Praxishandbuch.; Avak , Goris, Jäger, Schneider, Weickenmeier; 2003

Stahlbeton im Hochbau nach DIN 1045-1. Einführung und Anwendungsbeispiele.; Heydel, Krings, Herrmann; 2002
Stahlbeton nach DIN 1045-1.; Fischer, Kramp, Prietz, Rösler; 2002
Grundlagen der Bemessung nach DIN 1045-1 in Beispielen.; Litzner; 2002
DIN 1045 digital, m. CD-ROM; Schmitz, Goris; 2002
Stahlbetonbau-Praxis nach DIN 1045 neu, Bd.2, Bewehrung, Konstruktion, Beispiele; Goris; 2002
Stahlbetonbau-Praxis nach DIN 1045 neu, Bd.1, Grundlagen, Bemessung, Beispiele; Goris; 2002
Stahlbetonbau-Praxis nach DIN 1045 neu. Paket.; Goris; 2002
Spannbetonbauwerke 3. Bemessungsbeispiele nach DIN 1045-1.; Rossner, Graubner; 2002
Stahlbetonbau nach DIN 1045.; Albrecht; 2002
Stahlbeton- und Spannbetontragwerke nach DIN 1045 (2001). Erläuterungen zu Teil 1 bis 3 und Anwendungen.; Lohaus, Lierse, Roth, Göhlmann, Hansen, Kosmahl, Grünberg; 2002
Eisenbahnbrückenbau nach EUROCODE 2; Müller, Bauer, Uth; 2002
Stahlbetonbau aktuell - Praxishandbuch 2003; Avak, Goris; 2002
Stahlbetonbau aktuell - Praxishandbuch 2002; Avak, Goris; 2002
Stahlbetonbau aktuell - Praxishandbuch 2002; Mauerwerksbau aktuell - Praxishandbuch 2002. 2 Bde.; 2002
Stahlbetonbau in Beispielen, Tl.2, Konstruktion, Platten, Treppen, Fundamente; 2002

Beton-Kalender 2002; 2001
Beispiele zur Bemessung nach DIN 1045-1, Bd.1, Hochbau; Deutscher und Bautechnik-Verein E. V. Beton-; 2001
Bemessungstafeln nach DIN 1045-1 (2001).; Schmitz, Goris; 2001
Einführung in die DIN 1045-1. Anwendungsbeispiele; Zilch, Curbach; 2001
Stahlbetonbau- Praxis spezial DIN 1045 neu.; Holschemacher; 2001

Stahlbetonbau in Beispielen, Tl.1, Bemessung von Stabtragwerken; Avak; 2001
Stahlbetonbau aktuell 2001. Jahrbuch für die Baupraxis; Avak, Goris; 2001
Stahlbetonfertigteile. Unter Berücksichtigung von Eurocode 2; Bindseil; 1998
Grundlagen des Stahlbetonbaus. Einführung in die Bemessung nach Eurocode 2; Teubner; 1998

Stahlbetonbau nach EC 2; Albrecht; 1997
Spannbetonbauwerke, Tl.2, Bemessungsbeispiele nach Eurocode 2; Rossner, Graubner; 1997
Eurocode 2 für den Stahlbeton- und Spannbetonbau; Schmidt; Juni 1997

Bemessungsalgorithmen im Stahlbetonbau. Flußdiagramme nach Eurocode 2; Avak, Schmid; 1996

Stahlbeton im Hochbau nach EC 2. Einführung und Anwendungsbeispiele; Heydel, Krings, Herrmann; 1995
Stahlbeton- und Spannbetontragwerke nach Eurocode 2; Erläuterungen und Anwendungen; Bieger; 1995

Beispiele zur Bemessung von Betontragwerken nach EC 2. DIN V ENV 1992 Eurocode 2; 1994
Bemessungspraxis nach EUROCODE 2. Zahlen- und Konstruktionsbeispiele; Avak, Goris; 1994
Stahlbetonbau in Beispielen, Tl.1, Baustoffe, Grundlagen, Bemessung von Stabtragwerken; Avak; 1994

Euro-Stahlbetonbau in Beispielen, Tl.1, Baustoffe, Grundlagen, Bemessung von Stabtragwerken; Avak; 1993

Euro-Stahlbetonbau in Beispielen, Tl.2, Konstruktion, Platten, Treppen, Fundamente, wandartige Träger, Wände; Avak; 1992
Bemessungshilfsmittel zu Eurocode 2; Kordina; 1992 these and other german books see at: amazon.de, wiley-vch.de, baufachkatalog.de, bauwerk-verlag.de
Spannbetonbauwerke Teil 3: Bemessungsbeispiele nach DIN 1045-1 und DIN-Fachberichten; Rossner, Wolfgang / Graubner, Carl-Alexande; ISBN 3-433-02831-1
Beton-Kalender 20043; Bergmeister, Konrad / Wörner, Johann-Dietrich (eds.) ISBN 3-433-01645-3

Beton-Kalender 2003 und BK:/3 im Set; Bergmeister, Konrad / Wörner, Johann-Dietrich (eds.)
ISBN 3-433-01679-8
Beton-Kalender 2004; Bergmeister, Konrad / Wörner, Johann-Dietrich (eds.) ISBN 3-433-01668-2
Beton-Kalender 2004 und BK:/3 im Set; Bergmeister, Konrad / Wörner, Johann-Dietrich (eds.)
ISBN 3-433-01692-5
Bemessung von Betonbauten im Hoch- und Industriebau; Mehlhorn, Gerhard / Fehling, Ekkehard / Jahn, Thomas / Kleinhenz, Andreas
ISBN 3-433-02854-0
Fehler und ihre Vermeidung bei Tragkonstruktionen im Hochbau; Werner, Dirk ISBN 3-433-02848-6

French books

Génie civil béton arme application de l'eurocode 2; Nicot; 2001
FORMULAIRE DU BETON ARME. Tome 2, Fondations, Contreventement, Le projet en zone sismique, Règles BAEL 91, Eurocode 2, Règles Parasismiques 92; DAVIDOVICI; 1997

FORMULAIRE DU BETON ARME. Tome 1, Eléments de calcul, Interface béton armé, Charpentes métalliques, Règles BAEL 91, Eurocode 2, Règles parasismiques 92; DAVIDOVICI; 1996
these and other french books see at: amazon.fr

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German handbooks and design guidelines

Title	Autors	Publisher		
Straßenbrücken in Massivbauweise nach DIN- Fachbericht. Beispiele prüffähiger Standsicherheitsnachweise.	Thomas Bauer	Bauwerk	Gebundene Ausgabe	2002
Handbuch für Betonbau, Stahlbetonbau und Spannbetonbau, Brücken aus Spannbeton-Fertigteilen	Wolfgang Rossner	Ernst & Sohn Verlag	Gebundene Ausgabe	1988
Schadensfälle im Stahlbeton- und Spannbetonbau. Ursachen und Sanierung.	Max A. M. Herzog	Werner, Düsseldorf	Broschiert	2000
Handbuch für Betonbau, Stahlbetonbau und Spannbetonbau, Hallen aus Beton-Fertigteilen	Oskar Schmalhofer	Ernst & Sohn Verlag	Gebundene Ausgabe	1995
Brücken aus Stahlbeton und Spannbeton. Entwurf, Konstruktion und Berechnung.	Karl Heinz Holst	Ernst & Sohn Verlag	Gebundene Ausgabe	1998
Spannbetonbauwerke, Tl.2, Bemessungsbeispiele nach Eurocode 2	Wolfgang Rossner	Ernst & Sohn Verlag	Gebundene Ausgabe	1997
Spannbetonbauwerke, Tl.1, Bemessungsbeispiele nach DIN 4227	Wolfgang Rossner	Ernst & Sohn Verlag	Gebundene Ausgabe	1992

Brücken aus Stahlbeton und Spannbeton. Eurocode - Ergänzungsband.	Karl Heinz Holst	Ernst & Sohn Verlag	Broschiert	2000
Werner-Ingenieur-Texte (WIT), Bd.10, Balkenförmige Stahlbetonbrücken und Spannbetonbrücken	Hans Weidemann	Werner, Düsseldorf	Broschiert	1984
Eisenbahnbrückenbau nach EUROCODE 2.	Michael Müller	Bauwerk	Gebundene Ausgabe	2003
Spannbetonbau	Günter Rombach	Ernst & Sohn	Gebundene Ausgabe	2003
Spannbeton für die Praxis	Fritz Leonhardt	Ernst & Sohn Verlag	Gebundene Ausgabe	2001
Spannbeton. Grundlagen - Berechnungsverfahren - Beispiele.	Martin Thomsing	Teubner Verlag	Broschiert	2002
Spannbetonbau-Praxis. Mit vielen Zahlungsbeispielen.	Wolfgang Krüger	Bauwerk	Gebundene Ausgabe	2003
Straßenbrücken in Massivbauweise nach DIN-Fachbericht. Beispiele prüffähiger Standsicherheitsnachweise.	Thomas Bauer		Gebundene Ausgabe	2003
DIN, Hilfsmittel für die Arbeit mit Normen des Bauwesens, DIN 4227	Almut Rother	Beuth, Bln.	Broschiert	1988
Werner Ingenieur-Texte, Bd.63, Spannbeton	Helmut Kirchner	Werner, Düsseldorf	Broschiert	1997
Bemessungshilfsmittel zu Eurocode 2.	Karl Kordina	Beuth, Bln.	Broschiert	1992

Stahlbeton- und Spannbetontragwerke nach DIN 1045 (2001). Erläuterungen zu Teil 1 bis 3 und Anwendungen.	L. Lohaus	Springer, Berlin	Gebundene Ausgabe	2002

English handbooks and design guidelines

Reinforced and Prestressed Concrete Design:The Complete Process 1st Edition – Paper; Eugene O'Brien; Prentice Hall; Januar 1995; isbn 0-58221-883-7
Reinforced and prestressed concrete are the key construction materials of the twentieth century and are used in a wide range of structures from bridges to highrise buildings. This book provides a detailed and complete reference for the design of reinforced concrete structures. It offers an understanding of the inter-relationship between conceptual design, analysis and the detailed design of concrete structures. In addition to considering the traditional areas of concrete member design, the authors emphasize the importance of a qualitative understanding of the overall behaviour of structures. Provides civil and structural engineering students with complete coverage of the design of reinforced concrete structures. Great emphasis is placed on developing a qualitative understanding of the overall behaviour of structures.

Design booklets
Reinforced Concrete Building Series
The reinforcing Concrete Building Series have been developed in conjunction with Onesteel Reinforcing.
The design booklets of the Reinforced Concrete Buildings series have each been written to form two separate parts: Part 1- AS 3600 Design which provides insight into major new developments in AS 3600; and Part 2 – Advanced Design using OneSteel 500PLUS Rebar which leads to significant economic advantages for specifiers of OneSteel steel. These booklets are supported by 500PLUS computer software that will prove to be indispensable to design engineers who use AS 3600.
Current Design Booklets include:

RCB-1.1(1)	Design Booklet: Crack Control of Beams	Aug 2000
RCB-2.1(1)	Design Booklet: Crack Control of Slabs	Aug 2000
RCB-3.1(1)	Design Booklet: Cross Sectional Strength of Columns	Aug 2000
Addendum 1	Minimising Crack Control Reinforcement	Nov 2000

Design Booklet: Crack Control of Beams
August 2000

To control flexural cracking, the Concrete Structures Standard AS 3600-1994 required only the maximum spacing and concrete cover of the tension reinforcement to be limited, and often this did not guarantee acceptably narrow cracks. The new edition of *the Concrete Structures Standard AS 3600-20001 will allow 500 MPa reinforcing steels to be used in design. This will inevitably lead to higher steel stresses under serviceability conditions, thereby increasing the importance of designing for crack control. New design provisions, for crack control of beams in a state of either flexure or tension, that are proposed for inclusion in AS 3600-2000 are reviewed in this design booklet. They have essentially come from Eurocode 2, and their use needs to be well understood by designers in order to allow the full benefit of the increase in steel yield strength to be gained, leading to a significant reduction in steel area. This may require judicious detailing of the bars, crack control improving with a reduction in either bar diameter or bar spacing. A computer program* 500PLUSBCC ™ *(BCC standing for Beam Crack Control) is being released with this design booklet, and is the first from the* 500PLUS software suite. Download PDF file*(867 kb)*

Design Booklet: Crack Control of Slabs
August 2000

To control flexural cracking in slabs, the Concrete Structures Standard AS 3600-1994 required only the maximum spacing of tension reinforcement to be limited, and often this did not guarantee acceptably narrow cracks. The new edition of the Concrete Structures Standard AS 3600-20001 will allow 500 MPa reinforcing steels to be used in design. This will inevitably lead to higher steel stresses under serviceability conditions, thereby increasing the importance of designing for crack control under flexural conditions. New design provisions proposed for inclusion in AS 3600-2000, for crack control of slabs in a state of flexure, are reviewed in this design booklet. They have essentially come from Eurocode 2, and their use needs to be well understood by designers in order to design more serviceable reinforced-concrete structures, and also to allow the full benefit of the increase in steel yield strength to be gained, leading to a significant reduction in steel area. This may require judicious detailing of the reinforcing bars or mesh, crack control improving with a reduction in either bar diameter or bar spacing. A computer program 500PLUS-SCC™ *(SCC standing for Slab Crack Control) is being released with this design booklet, and is the second from the* 500PLUS software suite. Download PDF file(*879 kb)*

Design Booklet: Cross Sectional Strength of Columns
August 2000

This design booklet is concerned with the strength of reinforced concrete cross-sections of concrete columns subjected to combined axial force and bending moment and designed in accordance with AS 3600-1994 and some proposed changes contained herein. It provides rules essential for designers to efficiently detail the main (longitudinal) reinforcement. The need for these rules is largely the result of the introduction of 500 MPa as a standard strength grade. This is a significant increase on a current grade of 400 MPa for reinforcing bars.
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EN 1993 DESIGN OF STEEL STRUCTURES

Taylor, J. C.: EN 1993 Eurocode 3: Design of steel structures. Proc. ICE, Civil Eng. 144, Nov. 2001, pp. 29-32
Key chapters: general introduction of Eurocode 3

Muzeau, J. P.: Stability of structural members. Proc. Stability and Ductility of Steel Structures, Budapest, Akadémiai Kiadó, 2002, pp. 3-12
Key chapters: buckling resistance of members

Kamtekar, A.G., - Little, G.H. – Cunningham, A.: The plastic design of steel sway frames. Proc. ICE, Structures & Building 146, 1ugust 2001, No. 3, pp. 275-284
Key chapters: sway frame, plastic design

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Key chapters: general introduction of Erocode 3

Georgescu, M. - Dubina, D.: Calibration of buckling curves for the lateral-torsional buckling of steel members via EC.3 Annex Z Standard procedure. Proc. Eurosteel, Coimbra, cmm, 2002, pp. 271-280
Key chapters: lateral-torsional buckling of beams

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King, C.M.: Design of steel portal frames for Europe. Steel Construction Institute, P164, No. 68, 2002
Key chapters: plastic design according to ENV 1993

Greiner, R.: Recent developments of the new rules for member stability in Eurocode 3. Proc. Stability and Ductility of Steel Structures, Budapest, Akadémiai Kiadó, 2002, pp. 30
Key chapters: buckling resistance of members

Narayanan, R. – Lawless, V. – Naji, F.J. – Taylor, J.C.: Introduction to concise Eurocode 3 (C-EC3) – with worked examples. Steel Construction Institute, P115, No. 60, 1993
Key chapters: commentary on ENV 1993

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Key chapters: commentary on ENV 1993

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Balaz, I. - Kolekova Y.: Critical moments. Proc. Stability and Ductility of Steel Structures, Budapest, Akadémiai Kiadó, 2002, pp. 31-38
Key chapters: lateral-torsional resistance of beams

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Gantes, C. J. - Voyagaki, E.: Effective column lengths of plane frames with elastic lateral supports. Proc. Eurosteel, Coimbra, cmm, 2002, pp. 163-172
Key chapters: Appendix E of ENV 1993-1 (Critical buckling length of members under compression)

Bijlaard, F. S. K. - Steenbergen, H. M. G. M.: Lateral torsional stability of members with lateral restraint at various locations between the supports. Proc. Eurosteel, Coimbra, cmm, 2002, pp. 191-200
Key chapters: Lateral-torsional buckling of beams

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Key chapters: Lateral-torsional buckling of beams

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Key chapters: design guide for column and beam design in accordance with ENV 1993

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Key chapters: Lateral-torsional buckling of beams

Mljaars, J. - Stark, J. W. B. - Steenbergen, H. M. G. M. - Abspoel, R.: Lateral-torsional buckling capacities of coped girders. Proc. Eurosteel, Coimbra, cmm, 2002, pp. 252-260
Key chapters: Lateral-torsional buckling of beams

Mastrandrea, L. - Piluso, V.: Beam-columns under non uniform bending: Numerical simulation and interaction formulae. Proc. Eurosteel, Coimbra, cmm, 2002, pp. 262-270

Key chapters: Buckling resistance of members, interaction of bending and axial forces

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Key chapters: Buckling resistance of members, interaction of bending and axial forces

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Key chapters: Buckling resistance of members, interaction of bending and axial forces

Sapalas, V. - Kvedaras, A. K.: Calculation of uniaxially loaded tapered columns according to Eurocode 3. Proc. Eurosteel, Coimbra, cmm, 2002, pp. 362-367
Key chapters: Buckling resistance of members, compression members

Software:
Programmes developed by ARCELOR Group, and available free from www.alc.arcelor.com, cover in accordance with Eurocode 3:

- PORTAL : single bay portal frames,
- TRUSSES: predesign of large span trusses,
- PSL: (Predesign Software Library) predesign of steel and composite members,
- MUST: quick estimation of weight of multistory structures.

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Key chapters: simple calculation approach

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Key chapters: all prEN 1993-1-2

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Key chapters *guide on design, design tables*

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Franssen J. M.: Numerical determination of 3D temperature fields in steel joints. Second International Workshop “Structures in Fire”, Christchurch, 2002
Key chapters: connection design

Moore, D. B.: Full-scale fire tests on complete buildings. Proc. of the 2nd Cardington Conference “Fire, static and dynamics tests of building structures”, ed. Armer G. S. M., O’Dell T., E&FN SPON, 1997
Key chapters: all prEN 1993-1-2

Newman, G. M. - Robinson, J. T. - Bailey, C. G.: A new approach to multi-storey steel-framed buildings. The Steel Construction Institute, Ascot, SCI-P288, 2000
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Kirby, B. R.: The behaviour of high-strength grade 8.8 bolts in fire. J. Constr. Steel Research, Vol. 33 (1-2), 2001, pp. 3-37
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Schleich, J. B. - Krupa, J. - Newman, G. - Twilt, L.: Model code on fire engineering. ECCS No. 111, Brussels, 2001, p. 165, [ISBN 92-9147-000-65]
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Steel Construction Industry Forum: Investigation of Broadgate phase 8 fire. The Steel Construction Institute, Ascot, 1991
Key chapters: thermal insulation

Vila Real, P. M. M. - Franssen, J. M.: (1999) Lateral buckling of steel I beams at room temperature - Comparison between the EUROCODE 3 and the SAFIR code considering or not the residual stresses. Internal report No. 99/01, University of Liege, 1999
Key chapters: beam design

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Key chapters: beam stability

Peros, B. - Boko, I.: Calculation of temperature curves under the influence of actual fires in steel halls. Proc. Eurosteel, Coimbra, cmm, 2002, pp. 1345-1354
Key chapters: actual fire load

Outinen, J. - Mäkeläinen, P.: Behaviour of cold-formed thin-walled structural steel at high temperatures and after cooling down. Proc. Eurosteel, Coimbra, cmm, 2002, pp. 1387-1390
Key chapters: material model

Al-Jabri, K. S. - Burgess, I. W. - Plank, R. J.: Prediction of the degradation of connection characteristic at elevated temperature. Proc. Eurosteel, Coimbra, cmm, 2002, pp. 1391-1400
Key chapters: connections in fire

Kaitila, O. - Mäkeläinen, P.: Influence of initial imperfections on the behaviour of lipped channel columns at high temperatures. Proc. Eurosteel, Coimbra, cmm, 2002, pp. 1427-1435
Key chapters: buckling of thin-walled columns in fire

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Key chapters: columns under fire

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Dubina, D.: General report on cold-formed steel structures recent design and research advances.
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Key chapters: buckling resistance of members

Castells, A. G. - Carvajal, F. M.: Anti-sag influence on the lateral buckling resistance of purlins restrained by sheeting. Proc. Eurosteel, Coimbra, cmm, 2002, pp. 614-623
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Joó, A. L. - Ádány, S. - Dunai, L.: On the Eurocode 3 design method of cold-formed Z-purlins. Proc. Eurosteel, Coimbra, cmm, 2002, pp. 625-634
Key chapters: thin-walled purlins

Di Lorenzo, G. - Landolfo, R.: Comparative study of new connecting systems for cold-formed structures. Proc. Eurosteel, Coimbra, cmm, 2002, pp. 658-668
Key chapters: connections

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Garcia, J. D. C. - Pena, A. A.: Welded connections of cold-formed steel structures with Cu-Si. Proc. Eurosteel, Coimbra, cmm, 2002, pp. 1049-1057
Key chapters: welded connections

Szlendak, J. K.: Design moment-rotation characteristics for steel semi-rigid beam-column joints. Proc. Eurosteel, Coimbra, cmm, 2002, pp. 1059-1066
Key chapters: semi-rigid joints

Aribert, J. M. - Younes, I. - Lachal, A.: Low-cycle fatigue of steel sections subject to a transverse concentrated load: Experimental investigation and practical formulation. Proc. Eurosteel, Coimbra, cmm, 2002, pp. 1067-1078
Key chapters: beam-to-column welded joint subjected to low-cycle loading

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Key chapters: resistance of beam-to column moment connections

Batista, E. M.: Reliability and progress in design codes. Proc. Coupled Instabilities in Metal Structures (CIMS), Lisbon, Imperial College Press, 2000, pp. 661-671
Key chapters: all chapters of Eurocode 3, Part 1-3

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Key chapters: beam-column interaction formulas

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Key chapters: behaviour of steel frames

EN 1993-1-4 Design of steel structures - Stainless steel

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Key chapters: special features of stainless steel, modelling

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Key chapters: shear buckling

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Key chapters: bolted connections

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Key chapters: plate buckling effects from direct stresses, FEM calculations

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Key chapters: plate buckling effects from direct stresses

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Key chapters: plate buckling in shear

Sedlacek, G. et all.: Design of steel structures - Evaluation of test results for the design rules of shear buckling resistance for stiffened and unstiffened webs. CEN/TC250/SC3 Document No. II.5.1, 1996, 27 pp.
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Key chapters: plate buckling effects from direct stresses

Macháček, J.: *Design of stiffened plates in compression.* Proc. Metal Structures, Timisoara, 1997, s. 301-306 [ISBN 973-978-350-9]
Key chapters: plate buckling effects from direct stresses

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Key chapters: resistance to transverse load

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Key chapters: shell buckling

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Key chapters: shell buckling

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Advances in steel structures. Proc. 3rd Int. Conf. on Advances in Steel Structures, Ed. S.L. Chan, K.F. Chung, J.G. Teng, Hong Kong Polytechnic University, Dec. 2002, Hong Kong
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Key chapters: strength and stability of shells

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Key chapters: strength and stability of shells

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Key chapters: shell buckling

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Key chapters: shell buckling

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Key chapters: strength and stability of shell

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No background materials available.

Report of the
Working Group for the
Specific Project 8

Synergies between TN EUCEET and other activities under the SOCRATES Erasmus programme and European research Networks in civil engineering

SYNERGIES BETWEEN TN EUCEET AND OTHER ACTIVITIES UNDER THE SOCRATES ERASMUS PROGRAMME

Richard Kastner[1], György Farkas[2], Václav Kuraz[3],
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1 . PRESENTATION

Since the creation of the oldest universities, some elites travelled all over Europe to study or teach in different towns, and a European space of higher education in fact existed. But this European space of higher education concerned a very few elites and this situation finally lasted until the last seventies.

In 1987, the European commission began to develop different interesting and effective activities and instruments in order to promote the European education space. TN EUCEET belongs to these activities, but many other instruments, in the field of higher education are of great interest for the European Civil Engineering Education community:

- the Socrates-Erasmus program proposes support to different types of activities such as: Student and teacher mobility, Intensive Programmes, Joint development of curriculum, European Credit Transfer System (ECTS), Preparatory visits…
- Besides these activities supported by the European commission, other initiatives have been developed by the higher education institutions themselves as for example the creation of double degree curricula resulting from direct agreements between two universities, and also exchange activities for students and professors outside Europe.

All these networking and exchange ac tivities are of course beneficial to all participants of the higher education system in Europe. By sharing different experiences and allowing a better in depth knowledge of the education systems of different countries, these activities provide a fertile ground for innovation, the quest for quality, and the implementation of new ideas.

1.1 Objectives of Specific Project SP8

In this general context, the overall aim of SP8 was to report on these activities, essential for developing a European Civil Engineering Higher Education Space. The development of these networking and exchange activities will certainly help the students, who represent the future of the civil engineering community, to open their minds, scientifically and technically but also politically and socially.

The more specific objectives defined by the members of the SP8 project are:

- to report on the practices of the EUCEET partners in these different activities;

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- to analyse these different experiences and to identify the reasons for success and difficulties;
- to present a written report in order to disseminate the results and conclusion of the SP8 work.

1.2 Working method

The first meeting of SP8 group took place in Malta, during the general EUCEET II assembly, the 7th may 2004. This meeting gathered 15 participants and depending on the main group interest, it was finally decided to work on 4 main topics:

- Student mobility
- Teacher mobility & Preparatory visits
- European Credit Transfer System (ECTS)
- Double degree agreements

It was also decided to collect, if possible, some reports of specific experiences related to these topics.

To obtain the data relating more specifically to the field of Civil Engineering, 3 questionnaires were prepared by Nicoleta Radulescu (Teacher mobility & Preparatory visits), Antal Lovas (European Credit Transfer System) and Richard Kastner (Student mobility).

The different phases of the SP8 work (questionnaire preparation, data analyses, other reports) were discussed by Email exchanges and also during meetings held in Lyon (18^{th} February 2005) and in Budapest (13th May 2005), and the final results have been presented during the EUCEET II Final General Assembly in Paris (29-30 September 2005)

1.3 Membership of SP8

After this first meeting, 7 participants were finally actively involved in the SP8 activities:

Chairman: Pr Richard KASTNER, INSA Lyon (France)
Pr Ulvi ARSLAN, TU Darmstadt (Germany)
Pr György FARKAS, BUTE Budapest (Hungary)
Pr Václav KURAZ, CTU in Prague (Czech Republic)
Pr Antal LOVAS, BUTE Budapest (Hungary)
Pr Nicoleta RADULESCU, TUCE Bucharest (Romania)
Pr Jean-François THIMUS, UC Louvain, Louvain-la-Neuve (Belgique)

1.4 Final report

The final report presenting the outcome of SP8 group is organised in 6 parts:

- Presentation
- Student exchanges in the Civil Engineering higher education system in Europe (Richard Kastner)
- Socrates Erasmus Staff Mobility (Nicoleta Radulescu)
- Use European Credit Transfer System (Antal Lovas)

- The opportunity to earn a double degree (Gyorgy Farkas)
- Final conclusions

It is completed by an Annexe comprising some specific reports:

- Report on student exchange CTU in Prague, Faculty of Civil Engineering (Vaclav Kuraz)
- Student exchange CTU in Prague with non European Universities (Vaclav Kuraz)
- Report on student exchange INSA Lyon –GCU Department (Richard Kastner)

The Annex can be found on the CD attached to the volume.

2. STUDENT EXCHANGES IN THE CIVIL ENGINEERING HIGHER EDUCATION SYSTEM IN EUROPE

Richard KASTNER, Institut National des Sciences Appliquées de Lyon (France)

2.1 Introduction

If it is of long tradition that elites travelled and studied all over Europe, the European Union, while setting up the ERASMUS program brought in this field deep changes by developing these exchanges considerably. The European Commission started to invest itself in the mobility of the students in 1987, when a new program carrying the name of Erasmus was set up in the Member States. During this year, 3000 young pioneers carried out a period of studies in a partner university abroad.

In 1995, Erasmus was integrated in the general program of the Commission for the development of a European dimension of education (Socrates) and enriched by additional means. Thus, Erasmus started to play a part even more important in the development of a new model of higher education in Europe and to promote a European system of transferable credits in order to guarantee the recognition of the Erasmus studies.

Currently, more than 100 000 students pack their bags each year to spent up to twelve months in one of the European higher educational institutions (more than 1 800 institutions) located in the 30 participating countries (the 25 Member States of the European Union & Iceland, Liechtenstein, Norway; Bulgaria, Rumania). Thus, between 1987 and 2003, more than one million students had carried out a part of their studies abroad.

In the same time, this impulse given by the European Commission led many universities to also develop exchanges with non European countries.

Within the working group SP8 of EUCEET2 network, it appeared interesting to examine the development of these activities of student exchanges in the Civil Engineering higher Education community in Europe. To this end a questionnaire was designed aiming at reviewing the state of these exchanges in the field of Civil Engineering, of their administrative, academic and financial organisation, as well as of encountered difficulties.

After a short presentation of the questionnaire, the principal results of the survey are presented and commented on.

2.2 Presentation of the survey

2.2.1 The questionnaire

The questionnaire worked out by the working group SP8 is summarized below. It was sent to all the participants of the EUCEET network and also to other universities taking part in networks of student exchanges.

The principal elements of the questionnaire are presented here, the integral questionnaire being given in the Annex.

Questionnaire on student exchanges in
Civil Engineering Higher Education in Europe

Summary

1. General information on the institution
2. Student mobility management
   - *Administrative management*
   - *Academic management*
3. Types of mobility
   - *Description of the types of mobility*
     Undergraduate or postgraduate
     Type of exchange: study period, final project, work placement
     Duration and place in the curriculum
4. Mobility overview
   - *Bilateral agreements*
     Bilateral agreement in Europe or outside Europe: countries and number
   - *Exchange figures for outgoing students*
     Mobility type, number of students, total number of months or semesters
     Percentage of mobility and destinations
   - *Exchange figures for incoming students*
     One or two semester mobility, final project, others
   - *Balance of incoming and outgoing students*
5. Learning agreement and ECTS
   - *Use of the ECTS rules, minimum number of credits for a 1 semester exchange*
   - *Learning agreement*
     By who is the learning agreement proposed?
     By who is the final learning agreement signed
     Adaptation of the learning agreement to actual time conditions of the host university
   - *Recognition of the exchange period*
     On a global base or considering each individual subject
   - *Selection of the outgoing students*
     Is there a maximum number of outgoing students
     Selection criteria
     Selection jury
6. Financial support
   - *Types of financial support to the students*
   - *Percentage of outgoing students having a financial support*
   - *Approximate range of this financial support*
7. Success / failures
   - *Students stopping their exchange before the planned end*
   - *Number of ECTS credits really obtained*

2.2.2 List of universities participating to the survey

The following universities answered the questionnaire. When presenting the results, the university numbers in the graphs refer to the numbers indicated in the following list.

1	INSA Lyon	France
2	University of Architecture, Civil Engineering and Geodesy Sofia	Bulgaria
3	Riga Technical University	Latvia
4	Technical University Dresden	Germany
5	Delft University of Technology	The Netherlands
6	University. of Nottingham	UK
7	K.T.H. Stockholm	Sweden
8	Czech Technical University Prague	Czech Republic
9	University of Beira Interior	Portugal
10	Technical University of Lodz	Poland
11	Trinity College Dublin	Ireland
12	Rzeszow University of Technology	Poland
13	Ecole Nationale des Travaux Publics de l'Etat	France
14	Ecole Nationale Ponts et Chaussées	France
15	Budapest University of Technology and Economics	Hungary
16	Technical University. of Milano	Italy
17	Aristotle University of Thessaloniki	Greece
18	Slovak University of Technology	Slovakia
19	National Technical University of Athens	Greece
20	University of Florence	Italy
21	Catholic University of Louvain	Belgium
22	University of Liège	Belgium
23	Technical University of Civil Engineering Bucharest	Romania

As it can be noted, the 23 universities in this list belong to 17 different countries, which represent a satisfactory sample of European countries. If European Union Member States are considered, only the following countries are not represented in this survey: Austria, Cyprus, Denmark, Spain, Estonia, Finland, Luxembourg, Lithuania, Malta and Slovenia. But there are answers from Rumania and Bulgaria, which are participating to the Socrates Erasmus program.

2.3 Management of student exchange

With regard to the organization and the management of student exchanges, one can distinguish an administrative part and an academic part.

In the administrative part, one can consider the administrative relationships with all the partners concerned or supporting the exchanges of students: European institutions, networks of universities, organizations financing grants, services of reception and housing...

The academic part relates to the management of the studies: connection with other Civil Engineering Departments of partner universities, selection of the students, definition of the learning agreements, academic follow-up at the time of the stay abroad, validation of the results…

2.3.1 Administrative management

All the universities have a central office for student exchanges, but only 50% of the Civil Engineering departments have an office for student exchange (although all have an academic in charge of this topic).

The administrative management is made mostly by the University office (74%), or jointly by the university office and the department (22%) and in some rare cases by the department alone (4%)

2.3.2 Academic management

Concerning the academic management, the figures are opposite, the management being made mostly and logically by the Department (67%) or jointly by the university office and the department (24%) and in two cases only (9%) by the university office. This last case seems not very satisfactory for the departments.

In all cases, a good link between the University office and the Department offices in charge of the student exchange is important: in some universities, this link is realised by a commission gathering representatives of the university office and all the department offices and coordinators. Regular meetings of such a commission appear very efficient for organising and harmonising all exchange activities

2.4 Student mobility overview

In this section, and taking into account the great differences shown in our survey, a general overview of student exchanges will be established, considering the types of exchanges, the destination, the percentage of students having actually a stay abroad, the balance between incoming and outgoing students.

2.5 Types of exchanges

Three types of exchanges have been distinguished:

2.5.1 A study period abroad

Where the student takes in the host university subjects that he would have taken in his home university and which are taken into account for obtaining his degree.

In most of the universities, these study periods may last 1 or 2 semesters, but 20% do no authorise 1 semester study period and 20% do not permit 2 semesters study periods. These periods take place, depending on the universities, between the 4th and the last semester (8th or 10th).

2.5.2 A final year project,

The final year project can be a research type project or consists in a design work. This type of exchange is possible for 75 % of the universities. In the case of research type projects, the subject is sometimes chosen jointly by the two universities, which is a way of collaborating in the research field.

2.5.3 A work placement

This is not really an exchange, but a work experience in a foreign country. This concerns mainly the universities where a work placement is compulsory in the curricula. A work period abroad is possible in 25% of the universities, one offering the possibility of a very long duration for this work placement (up to 16 months).

2.6 General figures on mobility

2.6.1 Bilateral agreements for student exchanges

a. Agreements in Europe

Bilateral agreements constitute the framework in which the students can work out their project of exchange. Thus, the number of agreements is an indicator of the level of exchange activity (but other indicators as the percentage of students having carried out an exchange are also to be considered).

The range of the destinations offered is also an element able to encourage the students to make a stay abroad. However, a too great number of agreements can lead to a reduction in the quality of the exchanges, the effective contact being difficult to maintain. It should be noted that a common management, or at least an excellent coordination at the university level, between the various departments, constitutes a point favourable to the development and the maintenance of the agreements, which can be common to different departments.

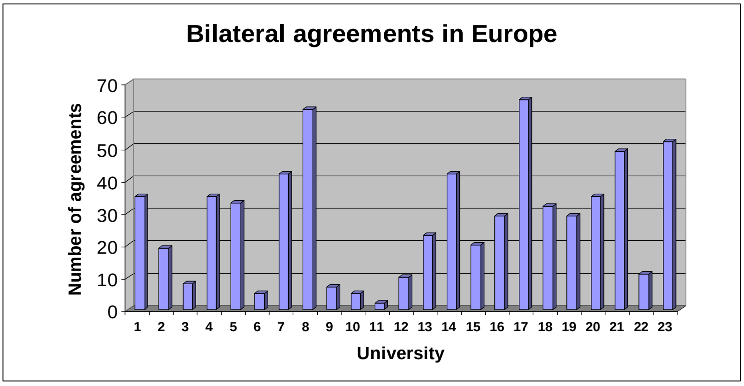


Figure 1. Number of agreements in Europe

The figure 1 presents the number of agreements active in the different universities participating to this survey. In average, there are 28 agreements per university, but the graph shows great differences, with a minimum of 2 agreements and a maximum of 65.

The distribution of this number of agreements shows clearly 3 groups (figure 2):

- a group of 7 universities with a number of agreements lower than 12
- the major group of universities (12) around the average (19 to 42 agreements)
- and a small group of 4 universities having more than 50 agreements

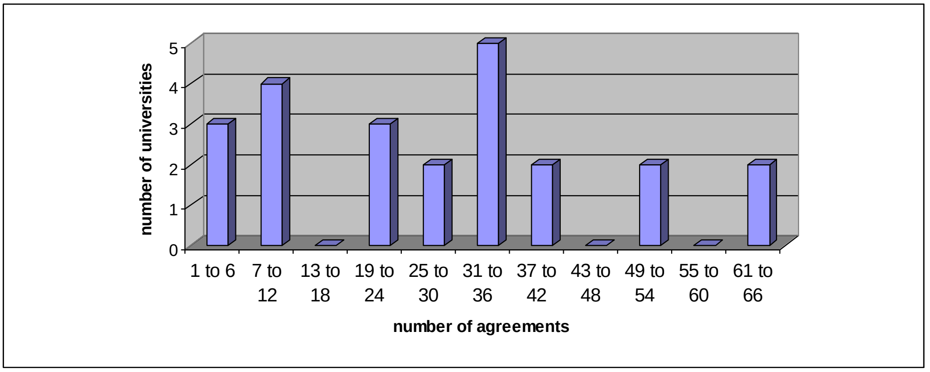


Figure 2. Histogram of agreements in Europe

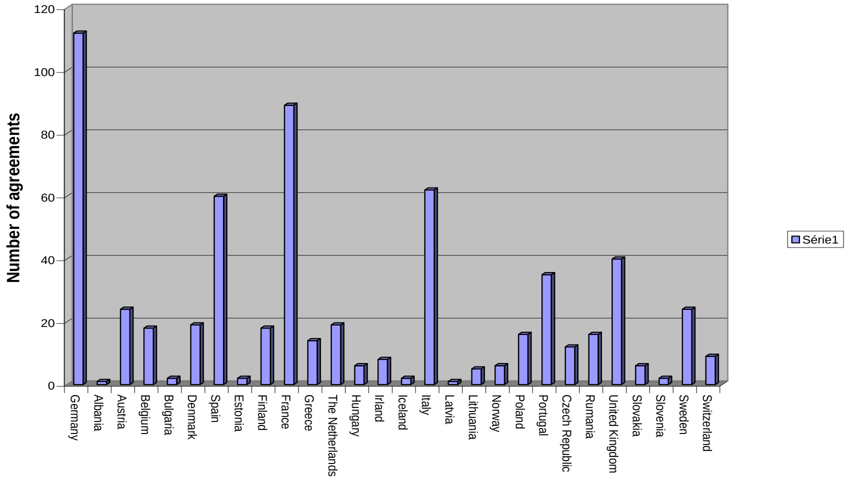


Figure 3. Agreements in Europe: number per country

Concerning the agreements, it was requested from each university how many agreements were signed considering the different countries. The results of this question are summarized on figure 3.

Four countries are clearly ahead (Germany, Spain, Italy and France with more than 60 agreements), followed by Portugal, the United Kingdom, Sweden and Austria which profit from 20 to 40 agreements. The other countries appear only for less than 20 agreements.

This result does not represent only the level of attraction of the countries and their dynamism to develop the student exchanges, but can be also a result of various difficulties for the students of some countries to study abroad. Thus for example, one can be astonished by the relatively low number of agreements for United Kingdom or Ireland, whose interest for the students of most of the other countries is proven: it is probable that the British universities limit the number of agreements because of the difficulty for them of finding candidates to study abroad in non-English speaking countries. For other countries, the difficulty for travelling abroad to study can result from financial problems related to a stay in a country where the cost of living is much higher.

b. Agreements outside Europe

As shown in figure 4, only 10 universities have agreements outside Europe, the number of agreements exhibiting also a large range (2 to 40)

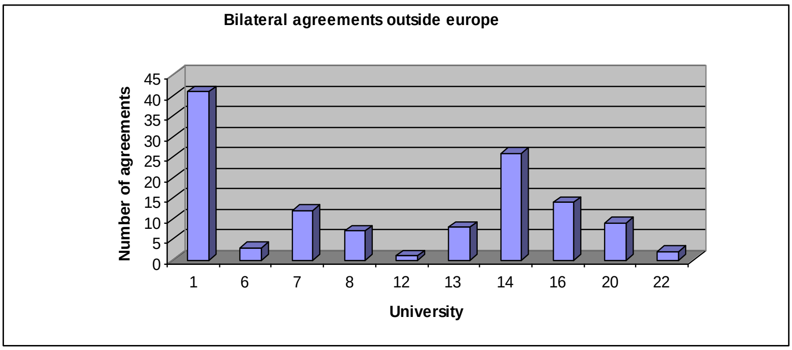


Figure 4. Agreements outside Europe

2.6.2 Number of students having a mobility

The percentage of graduate students who had mobility during their curricula is another important indicator of the level of exchange activities. It has to be noted that in the panel of Civil Engineering Departments participating to this survey, none has a policy of compulsory stay abroad (although in some universities, such a policy exists for other departments).

Only 10 answers to this question have been obtained. The figure 5 shows that considering all types of mobility (3 months minimum), 6 universities exhibit a percentage of exchange students lower than 20%, 2 only exhibiting a percentage greater than 60%.

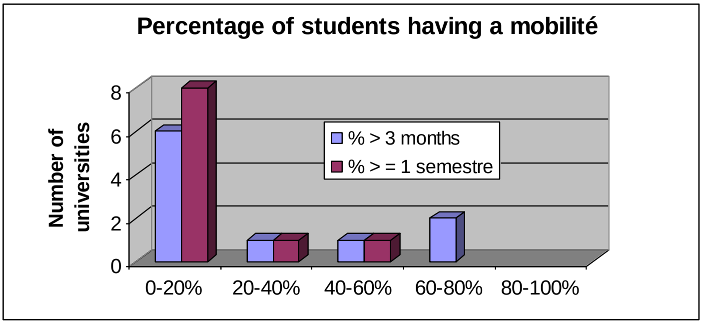


Figure 5. Percentage of students having mobility

These figures, as well as the large range in bilateral agreements show that a detailed analysis has to be made in order to find out the reasons for such differences, and what in practice favours or slows down the development of student exchanges.

The comparison between the number of agreements and the actual mobility activity presented in figure 6 shows clearly two figures:

- a first group of universities where the number of agreements seems to be well correlated to the mobility activity
- a second group exhibiting a medium to great number of agreements, but still a low mobility activity. In this group, there is obviously a policy of mobility development, but in practice difficulties to achieve high mobility percentages.

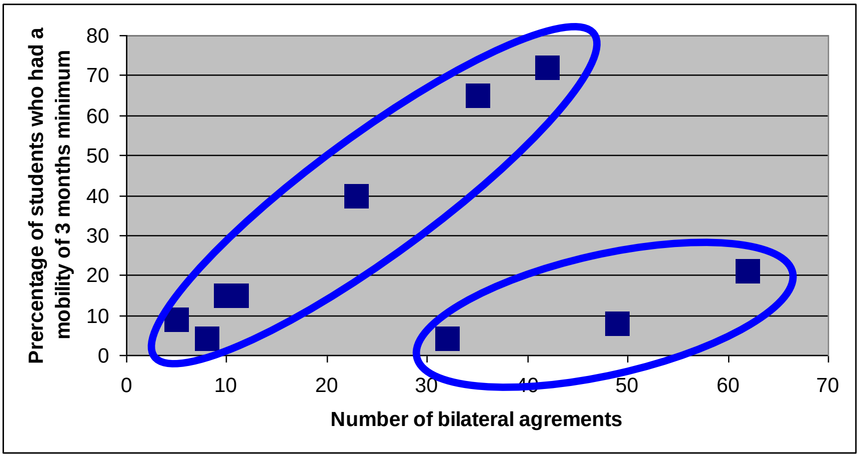


Figure 6. Percentage of students having mobility versus number of agreements

2.6.3 Destination of outgoing students

In accordance with the bilateral agreements, one notes logically that in the majority of the universities, the students have mobility in Europe (see figure 7). This confirms the interest of the Erasmus programs for developing the mobility of students.

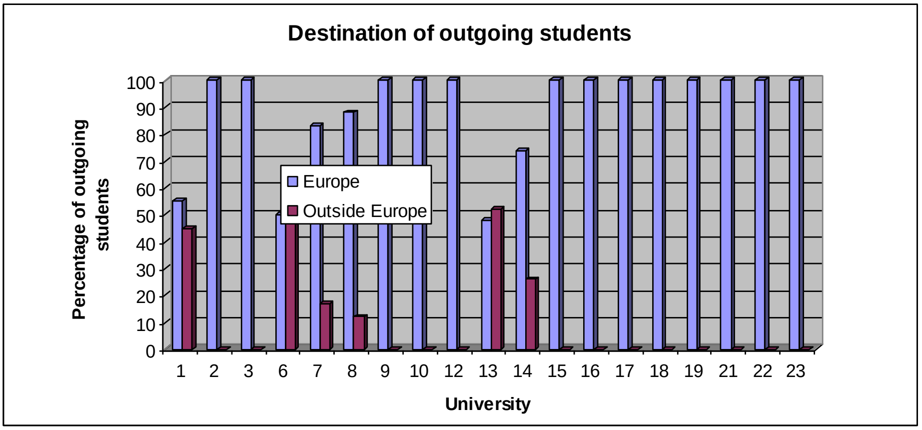


Figure 7. Destination of outgoing students

Six universities only exhibit mobility outside Europe. For this mobility outside Europe, the figure 8 shows that the destinations are generally very varied and cover all the continents.

One can note however the specific case of the university N°6 where the mobility is directed exclusively towards the USA: it is in fact an English university for which it is easier to establish exchanges with English speaking countries.

In a general way, it is more difficult to establish exchanges with the USA when the courses offered are not in English language. However, this graph where North America is always strongly represented shows the attraction of this region on the European students.

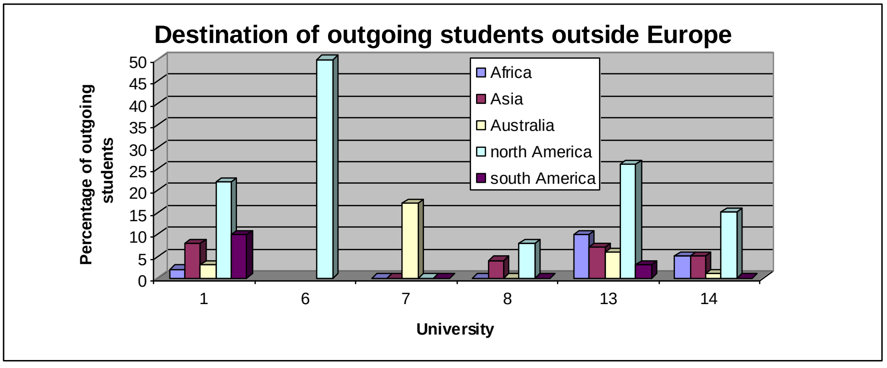


Figure 8. Destination of outgoing students outside Europe

2.6.4 Exchange balance

The principle of student exchanges supposes that flows of ingoing and outgoing students are nearly balanced, at least on average over several years. The graphics on figure 9 present the ratio of ingoing on outgoing students, counted in number of students or month of stay.

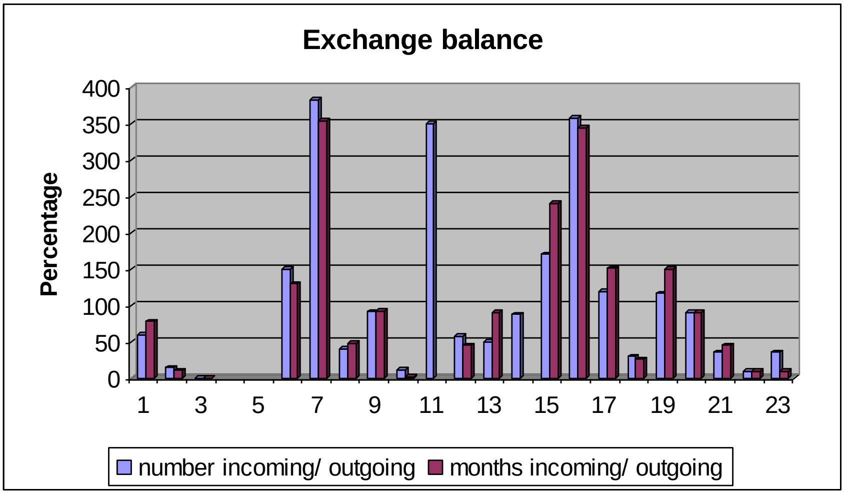


Figure 9. Exchange balance

This graph shows that the exchanges are seldom balanced, approximately a quarter only of the universities having a ratio ranging between 0.75 and 1.25. Nearly 45% of the universities on the other hand have a low ratio, lower than 0.75 and even in 20% of the case lower than 0.25.

That means that about half of the universities do not manage to balance their exchanges: they have more outgoing students that of incoming. This is compensated by universities having (and accepting) a very high ratio, 15% having a ratio higher than 3.

In the long run, this situation could lead to blocking; the universities which do not manage to attract exchange students having difficulties in finding places abroad for their own students.

2.6.5 Financial support

A major point for developing student exchanges is the financial support allotted to the students to cover the financial expenses due to the travel and stay abroad.

2.6.6 Percentage of student having a financial support and amount of the support

In nearly 70% of the universities, 100% of the students profit from a financial support for their stay in exchange and for 20% of additional universities, the number of students having a grant still ranges from 80 to 95%. There remain finally only three universities having lower percentages, but it should be noted that in two of them, some of the students have already a position of civil servant and thus have a regular salary!

2.6.7 Origin of the financial support

In all the cases, an important (and sometimes unique) part of the financial support to the student mobility comes from the European institutions, by the means of the Socrates/Erasmus program. But it should be noted that for two thirds of the universities exist complementary sources of financing such as grants allotted by the ministry of education, by regional authorities, by the universities themselves, by various international organizations or sometimes by private foundations. These grants can be allotted either on academic criteria, or sometimes on social criteria.

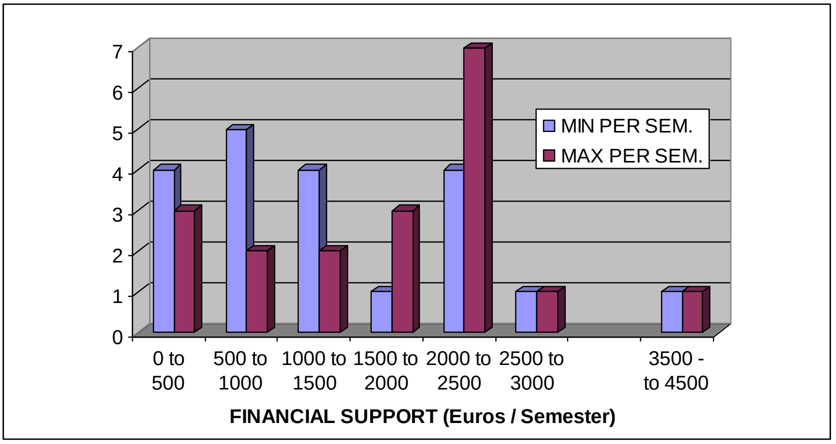


Figure 10. Distribution of the amount of financial support

The figure 10 gives the minimum and maximum amounts of the financial support allocated to the exchange students: these amounts are rather variable and lie essentially between 500 and 2500 euros per academic semester.

Apparently if these figures are considered, the majority of the students receive a financial support and for the majority, the financial amounts are far from being negligible, even if they are rather variable

However these figures can hide a much more important disparity, related essentially to the differences in standard of living between the various European countries.

Indeed, if the student leaves for an exchange in a country where the standard of living is equivalent to his country of origin, a financial support of about 1000 to 2000 euros per semester can cover all of the over costs related to its departure abroad. Indeed, in his university of origin, he must support equivalent costs of housing, food and other personal expenditure. The financial support thus does not aim to cover all the expenditure of the student but at least the additional expenditure related to its departure abroad. If the student makes his exchange in a country whose standard of living is lower, this support will give him even better material conditions of life than those he would have in his country of origin.

The situation is notably different when the student leaves for a country where the standard of living is notably higher than that of origin. In this case, the total of its budget at home added to his grant is generally quite lower than the sum necessary to live correctly in the host country. Moreover, additional financial means which would be necessary are sometimes equivalent or even higher than the average wages of his country of origin: in this case, it is generally impossible to the parents or to the student to mobilize such an amount. This constitutes without any doubt an important limitation to the exchanges between countries having very different standards of living.

A solution could consist, in the case of a balanced exchange, to have a cross payment of the costs of study, of housing and food, each student paying these expenses in his own university. Such an arrangement is proposed by the University of Prague for exchanging students with the USA and is presented in the paper written by V. Kuraz.

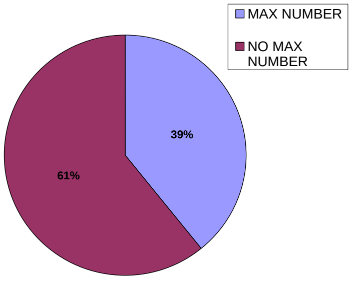
2.7 Validation of exchange periods

The principle of student exchanges is that the courses which are validated in the host university are taken into account in the curricula of the student to complete his degree. In that purpose, universities generally set up a procedure for selecting the students authorized to study abroad, with sometimes a maximum number. A procedure for defining the study plan, concretized by a learning agreement is also set up. The management of these procedures by the various universities taking part in this survey is presented hereafter.

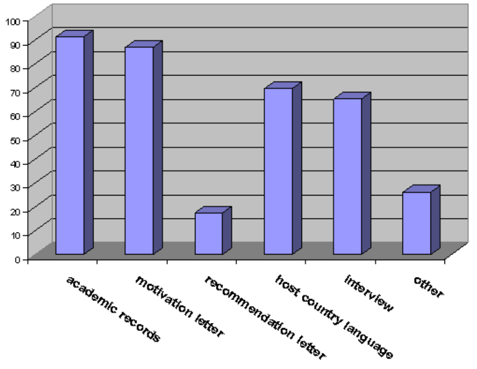
2.7.1 Selection of outgoing students

a. Limitation of the number (Figure 11 a)

Near 40% of the universities are limiting the number of students authorized to have an exchange period. This limitation can be imposed by the number of exchange students planned in the bilateral agreements. In some cases, it is also imposed by financial constraints. And finally, when the percentage of students having an exchange period is high, a limitation can also be foreseen in order to not strongly disturb the organisation of teaching activities.



a - Is there a maximum number of outgoing students?



b - Selection criteria

Figure 11. Selection of outgoing students

b. Selection criteria

Generally, and in order to limit the failures, the universities select the students authorized to study abroad, on various criteria related to the level of the students, their knowledge of the language of the host country, their motivation.

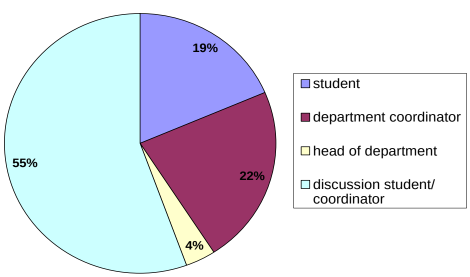
As shown on figure 11b, the main selection criteria used for selecting outgoing exchange students are their academic records and their motivation (more than 80% of universities), and, at a third level, their language skills. In more than 60% of the universities, the selection is also based on an interview.

2.7.2 Learning agreement

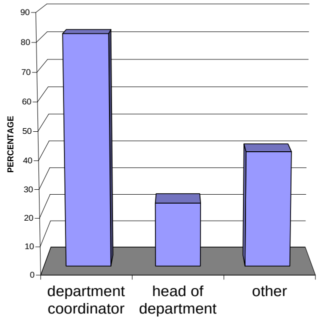
Considering the academic management of the exchange period, the learning agreement is the fundamental document which governs the period of study abroad. For this reason, it concerns well on the student, the University of Origin, which will have to validate the period of exchange, but also the host university which will offer the courses and which must make sure that the student has the prerequisite to follow the courses announced in the learning agreement.

a. How is this learning agreement elaborated?

Two thirds of the universities have a general framework to establish the study plan of exchange students. However, even when this framework exists, the study plan has to be to be adapted to the specific organisation of studies and curricula of the host university.



a – Who proposes the learning agreement?



b – Who signs?

Figure 12. Learning agreement

From figure 12 a, it appears that mostly (66%), the learning agreement is set up through a discussion between the student and the departmental exchange coordinator. For 19% of the answers, it is proposed by the student, but as it has to be signed by the university, there must be also in that case a discussion between the student and the coordinator. In all other cases, the learning agreement is directly proposed by the department (head or coordinator). Some universities, when signing the bilateral agreement, add a proposal of curricula. This is certainly a good way to manage the student exchange period from an academic point of view, but is also certainly a very provisional proposal of curricula in theses times of deep changes in the organisation of Civil Engineering studies

b. Who signs the learning agreement?

It is generally signed by the departmental coordinator, or by the head of the department. Various other cases appear in the survey, seeming more formal such as the President of the jury, the degree course council, the institutional coordinator…

Experience shows that in practice, the learning agreement signed before the departure of the student requires modifications, due to various constraints such as problems of timetable, courses not offered during the semester of exchange. Thus the original learning agreement can be modified by discussion between the student, the host university and the home university.

c. What is the minimum of ECTS credits for a 1 semester exchange

In theory, an academic semester corresponds to 30 ECTS credits. In the framework of exchanges, it is sometimes allowed that the number of credits to be obtained can be decreased, in order to take into account the difficulties related to the adaptation to another language and another educational system. It is also advisable to consider the difficulties for the student of building his timetable, his curricula being generally different from the standard curricula of the host university.

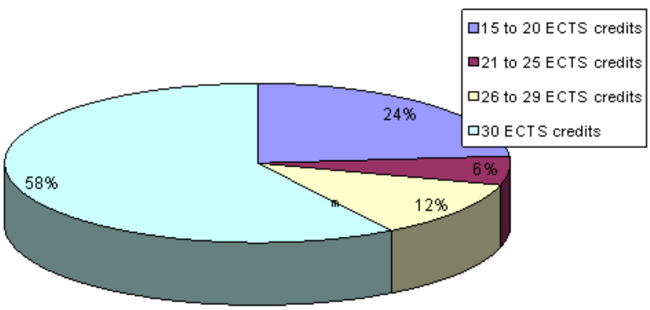


Figure 13. Minimum of credits

As shown on figure 13, more than 50% of the universities require 30 ECTS credits for one semester exchange, only about 20% accepting a number of credits between 20 and 30. But about a quarter of the universities accept a relatively low number of credits, ranging from 15 to 20. Although we had no question on this point, one can think that this corresponds to the case where the validation is made on the basis of individual subjects and not on a global basis.

2.7.3 Recognition of the exchange period

It appears indeed, as shown on figure 14 that generally (57%), the period of exchange is validated on the basis of individual subjects, whereas for 30% of the cases, the validation of the exchange period is global (i.e. one semester of exchange is recognized equivalent to one semester period in the university of origin).

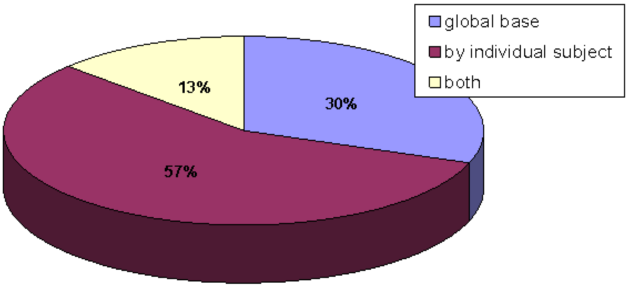


Figure 14. Recognition of exchange period

This last case probably corresponds to the universities where the curricula are based on a rather rigid organization in semesters or years, which are globally validated. Lastly, in some cases, the two systems cohabit: in these cases certainly exist at the same time annual or one term exchanges, as well as exchanges for the final year project which is recognized as an individual subject.

2.7.4 Success - failures

Setting up and managing student exchanges mobilizes much energy, but the plans of selection and follow-up of the students set up in the universities seems rather effective if one considers the number of students who successfully conclude their exchange period: indeed, figure 15 shows that in 90% of the cases, the rate of failure is lower than 10%, the success rate reaching even 100% in half of the universities having answered to this questionnaire.

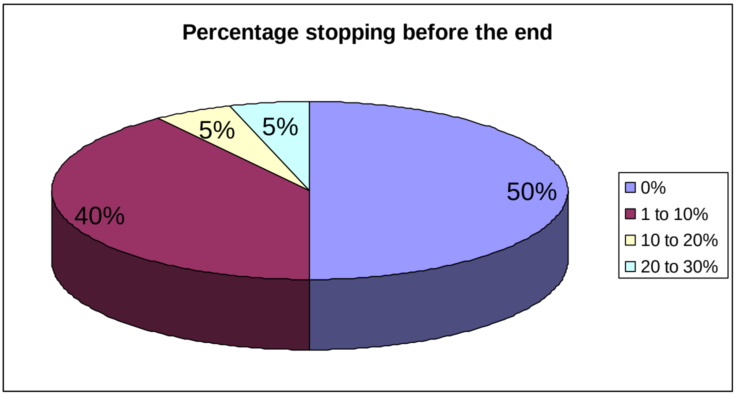


Figure 15. Percentage of students stopping before the end of an exchange period

2.8 Conclusions

Through this survey on the actual practice of student exchanges in the European higher education institutions in the field of Civil Engineering, the following elements can be highlighted:

All the institutions which answered actually develop these exchanges and set up specific structures of management. These structures generally exist at the University level for the Administrative Management of exchanges and at Civil Engineering Departments level for academic management. Leaving the academic management at the university level appears not very satisfactory.

Within the framework of the civil engineering studies, three principal types of stay abroad were highlighted:

- One or two semesters study period
- Final year project
- work placement

The importance of the exchange activity can be partly evaluated through the number of agreement signed by a university and also by the percentage of students having made an exchange during their curricula. If, considering these two criteria, the average level appears very good, one notes however strong disparities:

On average, each university signed 28 agreements, but some universities have less than 10 agreements, while others have more than 60.

Considering our panel of universities, they signed agreements with 28 European countries. But these agreements mainly relate to 4 countries (Germany, Italy, Spain and France and to a lesser extent the United Kingdom, Portugal, Sweden and Austria), the other country appearing only for less than 20 and sometimes 10 agreements.

This survey shows also that only a quarter of the universities have an approximately balanced exchange activity: most of them present a strong deficit in incoming students (with a ratio of incoming students /outgoing students < 0.5), some few universities having an imbalance in opposite direction (with a ratio of incoming students /outgoing students > 3). In this last case, there are two different situations: either these universities accept a great number of incoming students, or their students are not very mobile.

The exchange activity is mainly directed towards Europe, a third only of the universities having a significant activity towards other areas.

The level of mobility (percentage of students having carried out mobility equal or higher than three months) is also very variable, ranging from some percents to more than 70%. The lower levels of mobility can be partly linked with financial or language problems.

The financial support to compensate for the over cost for studying abroad is generalized, in particular through the Socrates program. Very often the Socrates support is supplemented by grants allotted by different institutions: ministry for education, regional authorities, the universities themselves… These supports are of a rather variable level and in addition, the differences in standard of living between the various countries poses problems still not satisfactorily solved. A solution promoted by the Czech Technical University of Prague could be helpful in some cases, each student paying the costs of study, of housing and food in his home university.

The studies followed during the stay abroad are generally recognized on the basis of each individual subject taken by the student, or, in one third of the cases, on a global basis (a semester exchange period being validated as an equivalent period by the home university)

The academic management of student exchanges (by means of the learning agreements) set up in the universities leads to a high success rate: 90% of the universities announce a rate of failure lower than 10%.

3. SOCRATES ERASMUS STAFF MOBILITY

Nicoleta RADULESCU, Technical University of Civil Engineering Bucharest (Romania)

3.1 Introduction

Questionnaire was prepared for the SP. 8 “Synergies between TN EUCEET and other activities under Socrates Erasmus program” aimed to quantify and monitor the Socrates Erasmus staff mobility within participating universities.

The Questionnaire is made up of six chapters requiring information about the staff mobility management, the actual teaching staff mobility over the past two years (2003/04 and 2004/05 academic years), the activity plan agreement of the teaching staff mobility as well as about the preparatory visits overview over the same period of time as mentioned above.

The questionnaire has been sent to all members of EUCEET, the responses are analyzed in the following chapters of this paper.

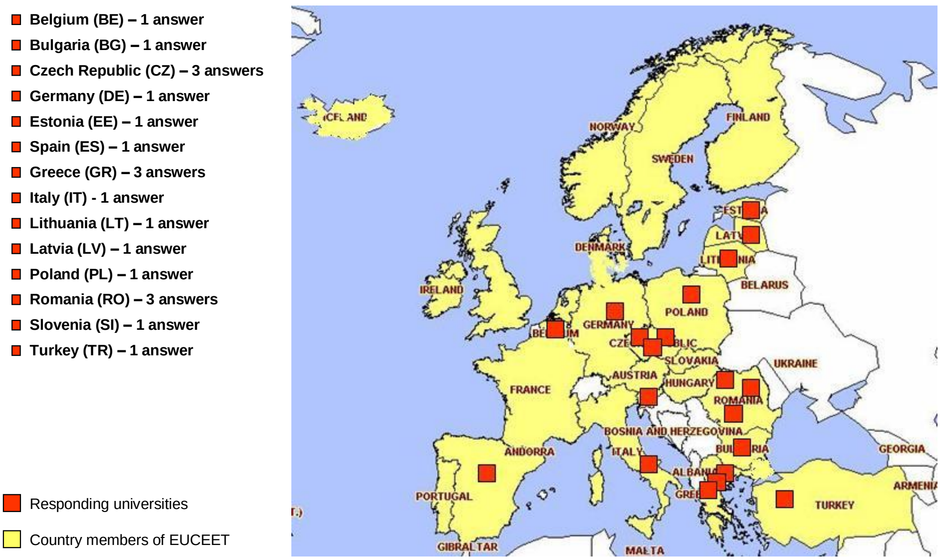
Hereby presented, questionnaire’s titles and format.

0	**GENERAL INFORMATION**
I	**STAFF Mobility MANAGEMENT**
I.1	**Responsibility for Staff Mobility**
I.2	**Special unit for Staff Mobilit [illegible] e)**
II	**TEACHING STAFF (TS) MOBILITY - GENERAL IDENTIFICATION TABLE**
III	**TS MOBILITY OVERVIEW in the last 2 academic years (2003/04 &2004/05)**
III.1	**Total number of Bilateral Agreements**
III.2	**Total activity period duration spent abroad for the Outgoing academic staff**
III.3	**Number of Outgoing academic staff / academic staff position**
III.4	**Total activity period duration spent abroad for the Incoming academic staff**
III.5	**Number of Incoming academic staff / academic staff position**
IV	**ACTIVITY PLAN AGREEMENT of the TS Mobility**
IV.1	**By whom is the content of the Activity plan agreement proposed ?**
IV.2	**By whom is the final content of the Activity plan agreement approved and signed?**
V	**PREPARATORY VISIT (PV) - GENERAL IDENTIFICATION TABLE**
VI	**PV MOBILITY OVERVIEW in the last 2 academic years (2003/04 & 2004/05)**
VI.2	**Total activity period duration spent abroad for the Outgoing staff**
VI.3	**Number of Outgoing staff / staff position**
VI.4	**Total activity period duration spent abroad for the Incoming staff**
VI.5	**Number of Incoming staff / staff position**
VII	**FINAL REMARKS [illegible] e)**

3.2 Questionnaire results analyses

3.2.1 General information

Questionnaire has been sent to 101 universities throughout Europe. Twenty institutions have answered the questionnaire within the deadline. Universities from Belgium (one), Bulgaria (one), Czech Republic (three), Germany (one), Estonia (one), Greece (three), Italy (one), Lithuania (one), Latvia (one), Poland (one), Romania (three), Slovenia (one) and Turkey (one) have returned the questionnaire.



The six chapter questionnaire sum up a total of 72 independent questions, thus expecting a total of 1440 answers from the twenty institutions responding.

However, the degree of completion of the questionnaire is only of 40% (a total of 588 eligible answers).

The degree of completion varies from a mere 26% for "Preparatory visits overview in the last two academic years to 59% of completion for "Activity plan Agreement on Teaching staff mobility".

3.3 Staff mobility management

The department/university may be its own responsible for the staff management mobility. Nevertheless, a special unit of the institution can be created to uphold the responsibility or even an external organization can be in charge.

Among the universities interviewed, 8 out of 20 hold only a special unit as manager, 5 are responsible themselves, six of them have a double responsibility (special unit and faculty) and only one hold a triple quality (special unit, faculty and external organization), as shown in the n°1chart.

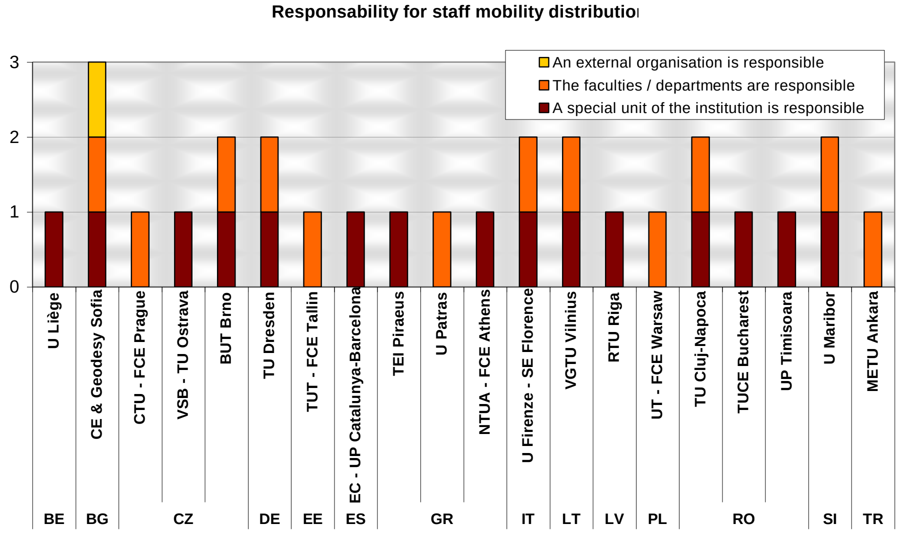


Chart n°.1

Regardless of the fact that some universities may have a special unit to manage the program, strategies and missions within the EUCEET may be defined either by the unit itself or the origin institution. As a matter of fact, 15 out of 20 respondents hold a special unit to manage the staff mobility activities. The majority (11 out of 15 – 73%) of the special units' missions and strategies are outlined by the origin institutions, only 4 (27%) special units are their own managers.

The special units' staff is composed both of academic and administrative members, averaging four for each category. Distribution by university is shown in n°2 chart.

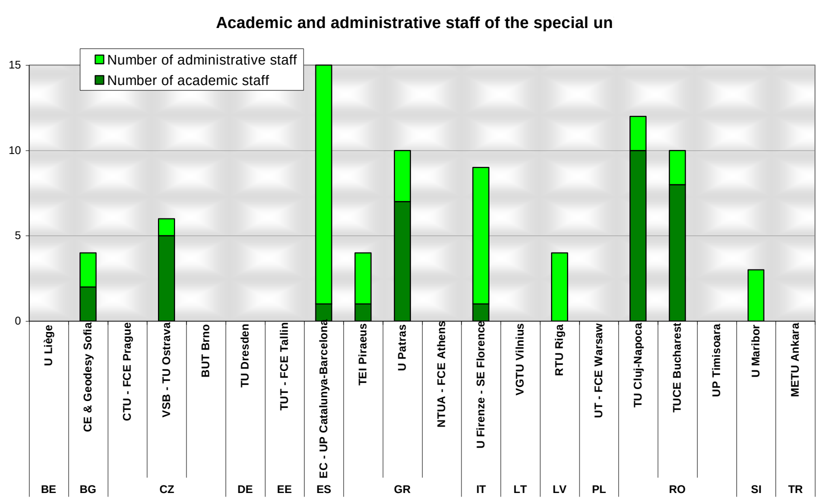


Chart n°.2

3.3.1 Teaching staff mobility overview over the past two academic years (2003/04 & 2004/05)

The total number of bilateral agreements signed by the responding universities is relatively stable over the specified period (452 and for 457 for 2003/04 respectively 2004/05) with an average of 23/25 bilateral agreements. 70% of received answers indicate a total number of Bilateral Agreements concluded during the past two years is below average

Distribution of signed bilateral agreements is shown in the n°3 chart.

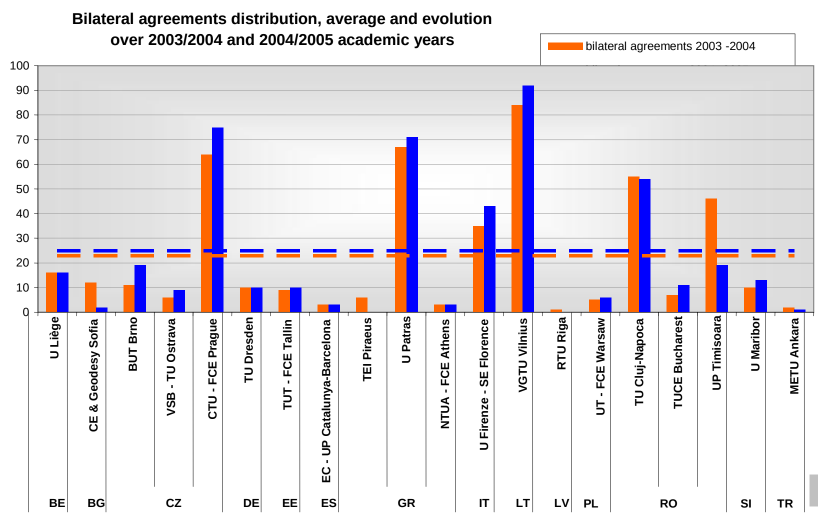


Chart n°.3

Existing bilateral agreements may be summed up in order to get a vision of the exchanges per country, as well averaged to obtain vision of the exchanges per university.

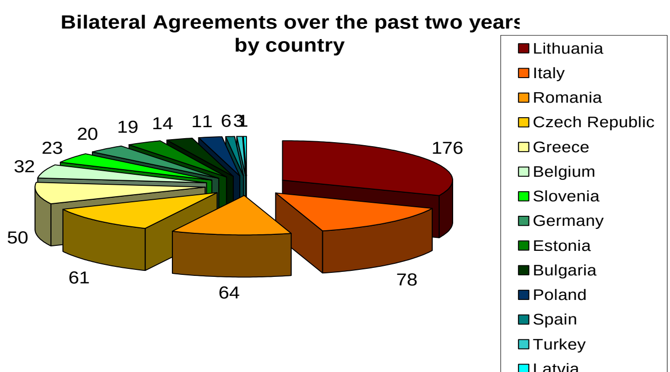


Chart n°.4

Over the past two years and according to the received answers, at country level, Romania, Lithuania and Czech Republic (7/20 partners) have been the most active holding 61% of the existing bilateral agreements, as shown in the chart n°4.

Furthermore, as mentioned before, Lithuania's VGTU has a relative share of 19% of the agreements, more than doubling the number two ranked university, Italy's U Firenze School of Engineering, as shown in the charts n° 5.

These bilateral agreements translate into time spent abroad by teaching staff, whether regarded as outgoing or incoming staff. The time may be either quantified in working days or teaching hours spent abroad within the agreements.

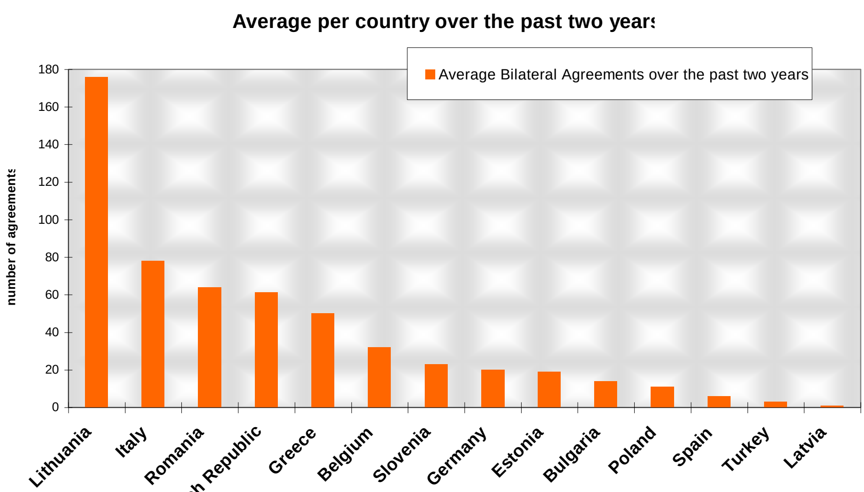


Chart n°.5

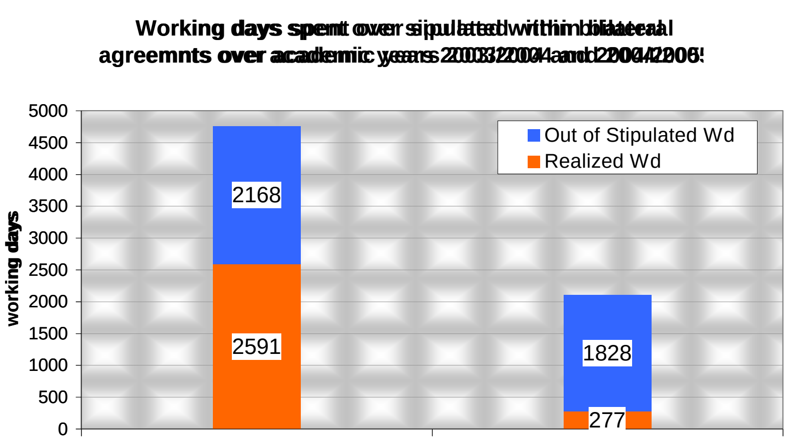
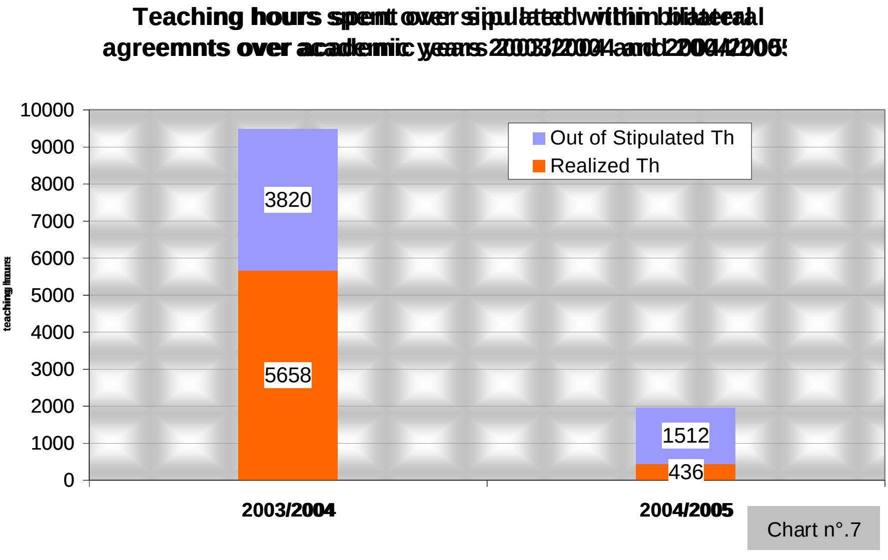


Chart n°.6

From an “outgoing staff” perspective, reports show a total of 4759 working days stipulated during academic year 2003/2004. Of those, only 54% (2591) have been actually fulfilled. (Chart n°6)

As shown above, activity dropped rather drastically in 2004/05, down to 44% (2105) as far as stipulated working days are concerned, and even more abrupt as far as realized working days are concerned : a mere 277 (13% rate) were completed (11% of realized 2003/04).



Situation is even more discrepant regarding effective time (teaching hours), as shown in the n°7 chart.

If zoomed at university level, 10 out of 15 establishments (67%) have a realized/non realized ratio above 50% for an average ration of 42% (Chart n°8).

As far as effective teaching hours spent are concerned, we notice only a 53% degree of accomplishment. Nevertheless, 10 out of 15 partners have a percentage superior to 50%

Working days spent over sipulated within bilateral agreements over academic years 2003/2004 and 2004/2005

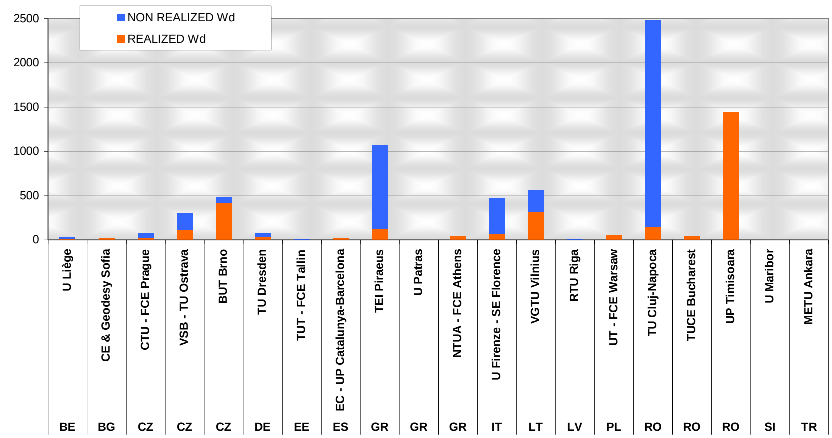


Chart n°.8

Teaching hours spent over stipulated within bilateral agreements over academic years 2003/2004 and 2004/2005

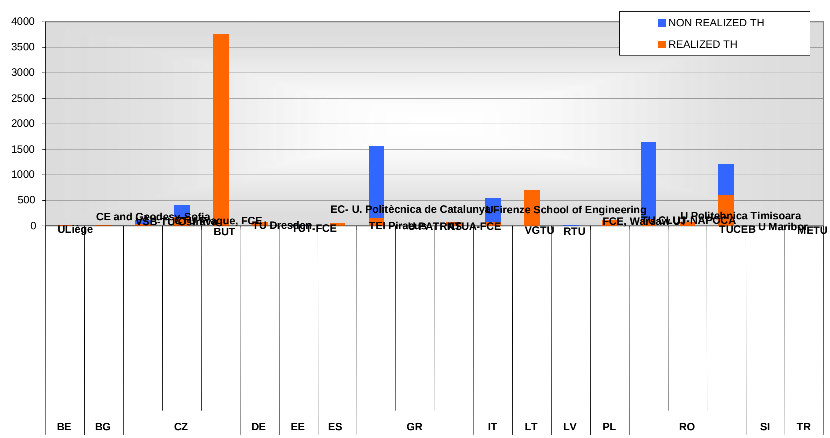


Chart n°.9

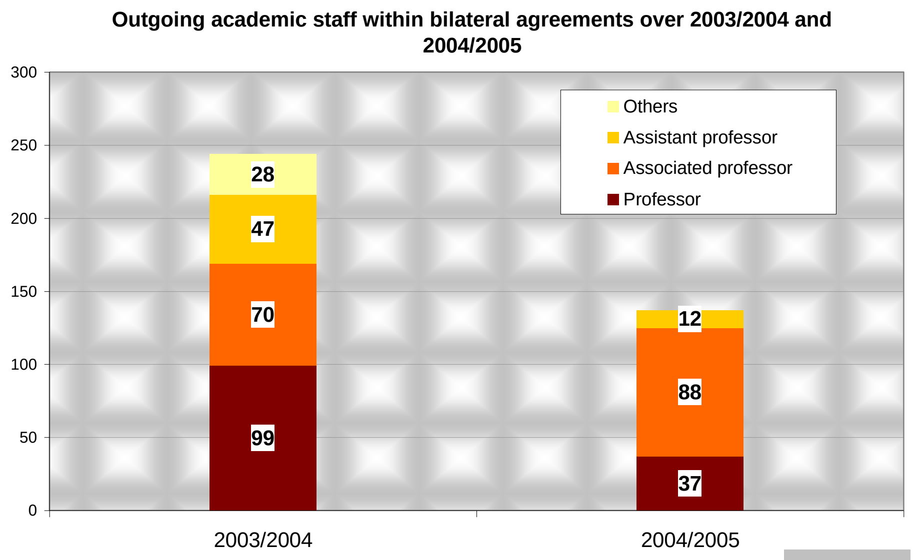


Chart n°.10

Categories of academic staff going abroad within the program are: professors, associated professors, assistants professors and others. A total of 244 academic staff went abroad during academic year 2003/04, preponderantly professors (41%) and only 137 in 2004/05 (a non negligible 44% drop). The number of professors was cut off by 62% (37) whilst the outgoing associated professors rose 25% to 88 (72 during 2003/04), as shown in charts n° 10 & 11.

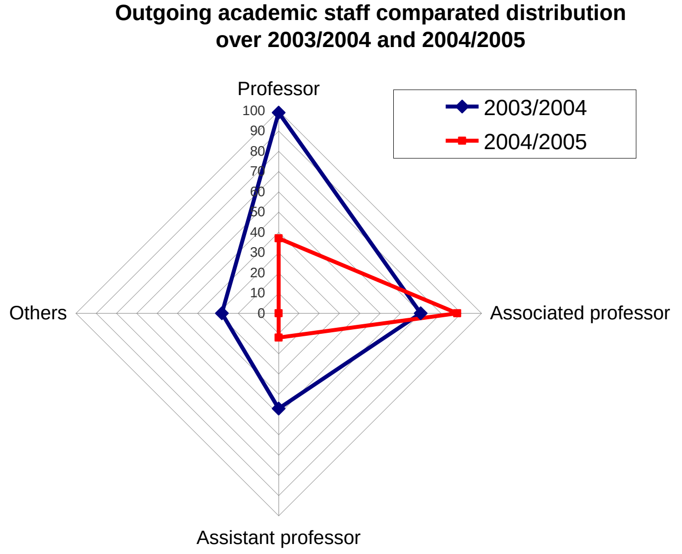


Chart n°.11

Working days spent over sipulated within bilateral agreements over academic years 2003/2004 and 2004/2005

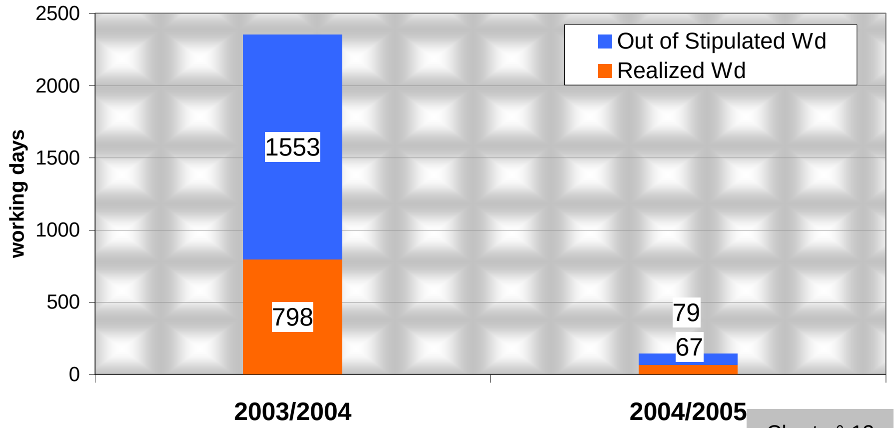


Chart n°.12

As shown in chart n° 12, hosting incoming staff have dropped drastically for the respondents in 2004/05 compared to 2003/04, to only 6% for the stipulated working days and 8% for realized ones.

In 2003/2004 rate of realized over stipulated has not been satisfying (34% - 798 out of 2351 working days), rose to 46% fulfilment rate in 2004/05.

Teaching hours spent over sipulated within bilateral agreements over academic years 2003/2004 and 2004/2005

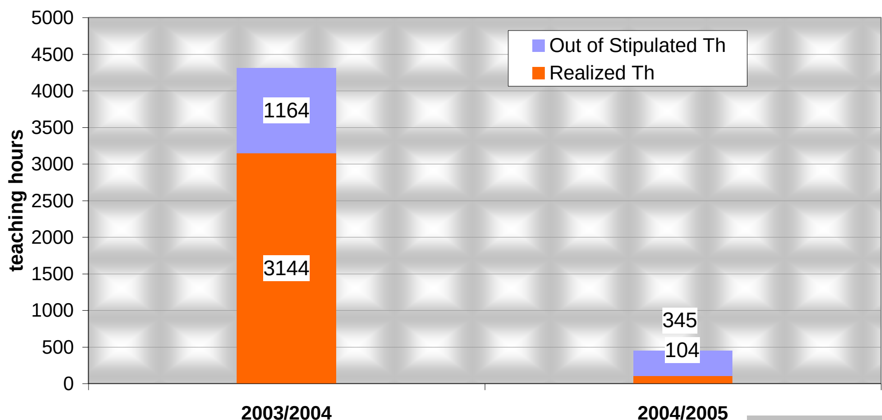


Chart n°.13

In “teaching hours” terms, situation is the same more or less (Chart n°13)

A massive relative drop of 90% in stipulated time in 2004/05 (compared to 2003/04), and even more worrying drop in realized host time, only 3% of 2003/04 at 104 hours in total.

Over the past two years, the degree of completion is only of 35% for the incoming staff, but half of the respondents, (6 out of 12) have a ratio exceeding 50%.

Working days spent over sipulated within bilateral agreements over academic years 2003/2004 and 2004/2005

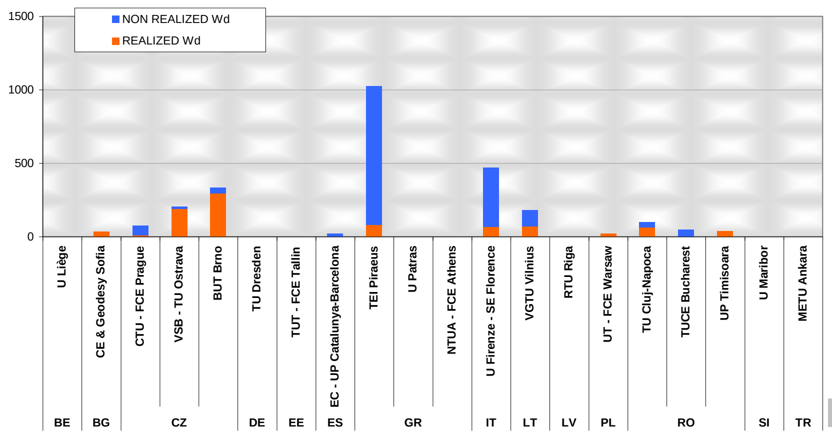


Chart n°.14

Teaching hours spent over sipulated within bilateral agreements over academic years 2003/2004 and 2004/2005

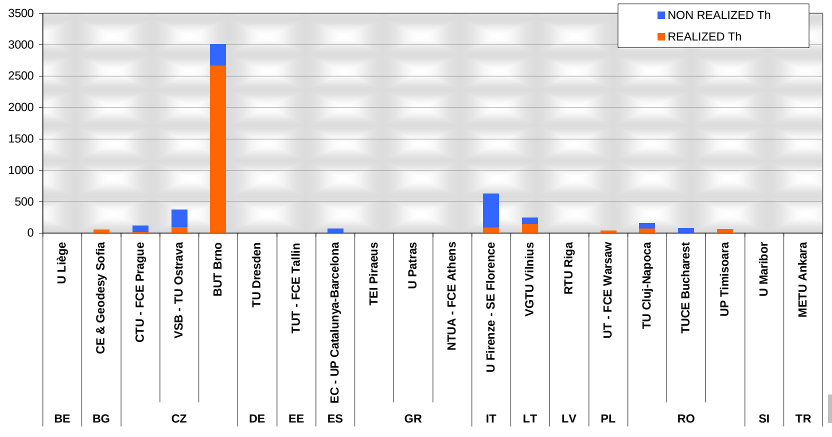


Chart n°.15

68% is the ratio of realized/non realized in terms of effective teaching hours over the past two years. Marginally more than 50% (6 out of 11 institutions) have a ration of realization above 50%, as shown in chart n°15.

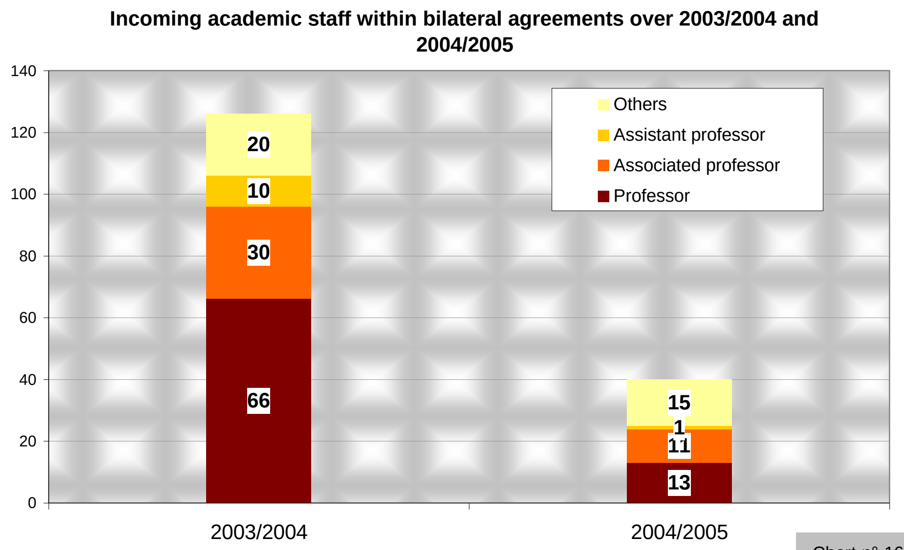


Chart n°.16

The incoming staff dropped in number from 126 in 2003/04 down to 40 in 2004/05 (68% drop). All categories have been reduced; professors visiting the responding universities were only 13 in 2004/05 as opposed to 66 in 2003/04, as shown in charts n° 16 & 17.

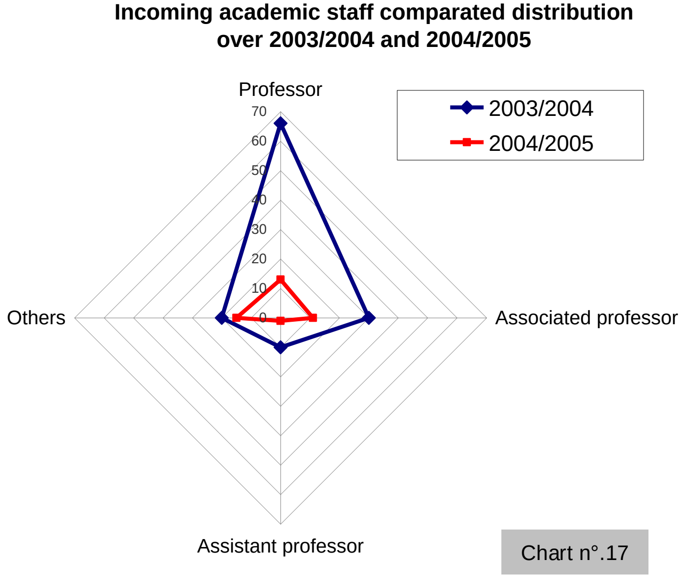


Chart n°.17

3.3.2 Activity Plan Agreement on Teaching staff mobility

Bilateral agreements are the result of a joint effort from both parties. Therefore it is interesting to question one-self over the relative weight in the process of proposing and decision making related to bilateral agreements. As shown in the questionnaires, most universities (13 out of 17 respondents) jointly propose the activity plan (host and origin university) (Chart n°18)

Activity Plan Agreement content proposal actors

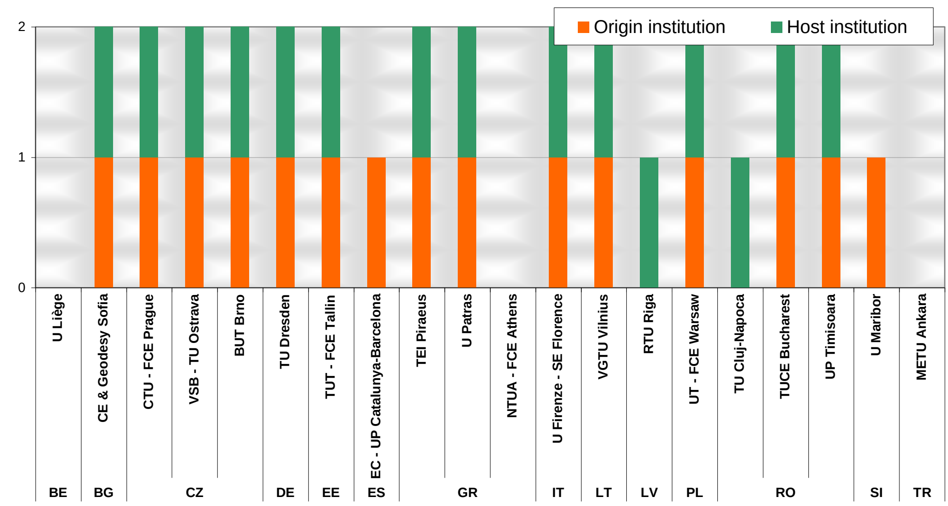


Chart n°.18

As for the decision making process, more intuitionals are involved, as financers of the programs should be involved (Chart n° 19).

Activity Plan Agreement content actors

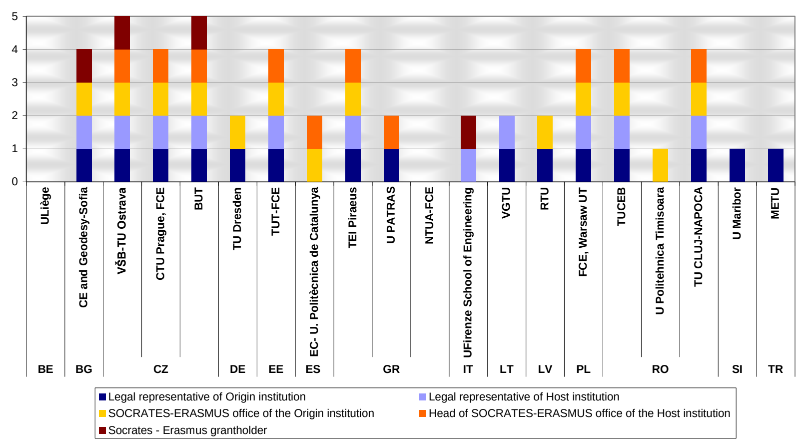


Chart n°.19

39% of Activity Plan Agreement (APA) is approved and signed by 4 actors, 33% by 2 actors, 17% by 1 actor and 11% by all 5 actors.

The main actor is the Legal Representative (LR) of Origin Institution (OI) (83%) followed by Socrates-Erasmus Head (SE H) of OI (72%), LR of Host Institution (HI) (61%), SE H of HI (56%) and SE grant holder (22%).

3.4 Preparatory visits mobility overview over the past two academic years (2003/04 & 2004/05)

Bilateral agreements are the result of preparatory visits and discussions. Therefore it is important to look into the under steps that have been taken during these past two years for new and strengthened collaboration between universities.

A total of 35 actual working days (out of 60 stipulated) and no less than 88 contact hours (out of 132 stipulated) have been used during academic year 2003/04 for outgoing preparatory visit.

Academic year 2004/05 was much poorer in contacts with only 6 out of stipulated 7 working days and 3 out of 12 contact hours. (Charts n° 20 & 21)

Total activity period duration spent abroad for the Outgoing staff over academic years 2003/2004 and 2004/2005

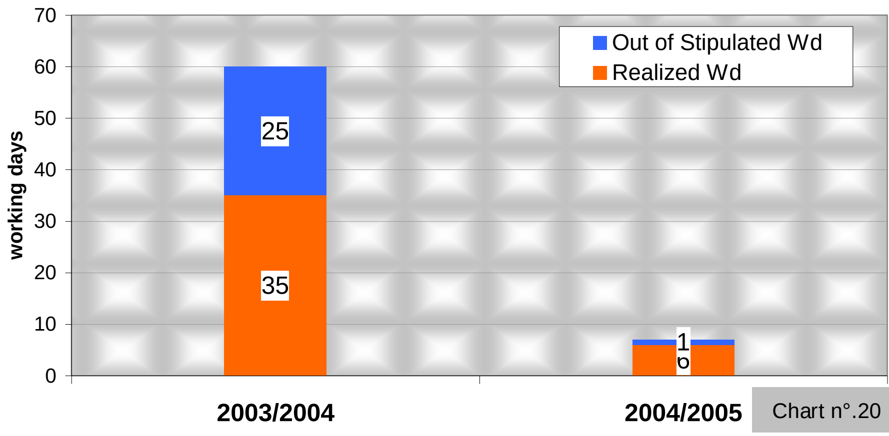


Chart n°.20

Total activity period duration spent abroad for the Outgoing staff over academic years 2003/2004 and 2004/2005

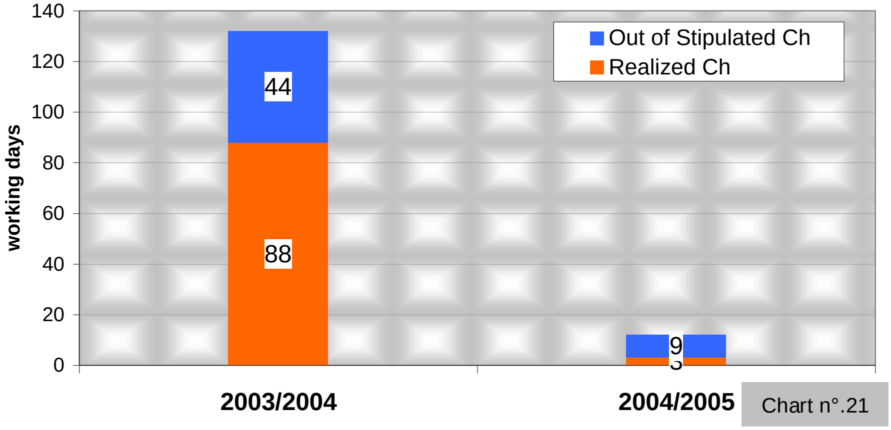


Chart n°.21

In 2003/04 some 16 academic staff and 3 administratives of the responding universities visited partner universities, whereas in 2004/05 only 3 academic staff made the effort.

As far as receiving preparatory visits, the twenty universities responding to the SP8 questionnaire have been strongly involved in 2003/04 with no less than 39 working days and 114 contact hours realized (near 100% rate realized/stipulated). In academic year 2004/05, 17 days and 49 have been stipulated but, most unfortunately, none have been realized. (Charts n° 24 & 25)

Total activity period duration spent abroad for the Incoming staff over academic years 2003/2004 and 2004/2005

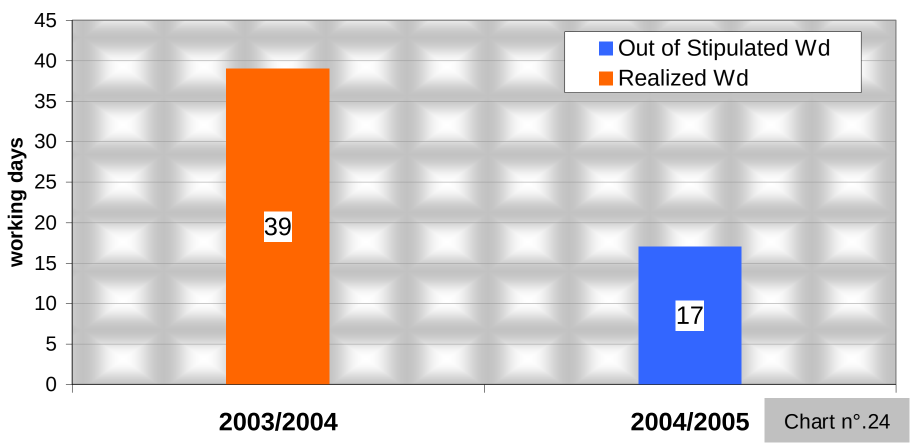
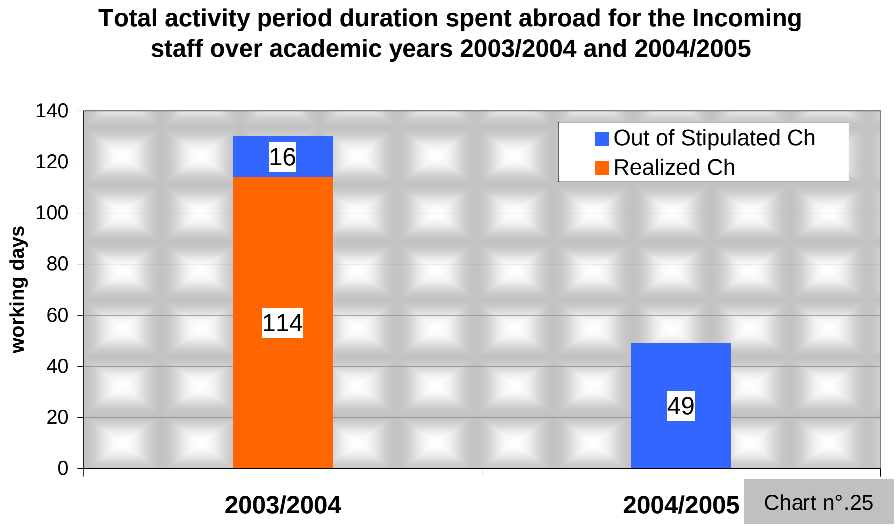


Chart n°.24



22 staff members have been received during 2003/04 by the universities, and although activity dropped during 2004/05 at only 8 visits received, it may be considered more gratifying than the 3 staff that went abroad to pay preparatory visits during 2004/05.

3.5 Remarks and comments

3.5.1 Staff Mobility Management

The responsibility for SMM belongs in 70% of cases to a Special Unit having both Academic and Administrative Staff.

3.5.2 Teaching Staff Mobility overview

Total number of Bilateral Agreements concluded during the period concerned is practically the same for each academic year, with a ratio of 23 per institution.

Total activity period duration spent abroad by the Outgoing Academic Staff dropped 89% in 2004/05 as compared to 2003/04 for the number of working days and 92% for the number of teaching hours respectively.

Total activity period duration spent abroad by the Incoming Academic Staff represents 8% of that realized in 2003/04 for the number of working days and only 3% for the number of teaching hours.

Total number of Outgoing Academic Staff decreased to 44% in 2004/05 vs. 2003/04.

Total number of Incoming Academic Staff dropped 68% in 2004/05 vs. 2003/04.

Although the number of Bilateral Agreements signed during each of the last two academic years remains the same, the actual activity diminished drastically in 2004/05:

both for Outgoing and Incoming Academic Staff in number of working days and teaching hours and persons number involved.

3.5.3 Activity Plan Agreement of the TS Mobility

APA is jointly proposed by the Origin and Host Institutions in a proportion of 76% of the cases.

Final content of APA is approved mainly by the Legal Representative and the Socrates-Erasmus Head of the Origin Institution.

3.5.4 Preparatory Visits Mobility

PVM activities performed both by the Outgoing and Incoming Staff followed the same evolution as TSM from 2003/04 to 2004/05.

PVM thus diminished by 70% in average for the number of working days and even 75% for the number of actual contact hours.

3.6 Conclusion

Although the SP8 Questionnaire has been sent to fulfilling to all 101 institutions part of the program, only 20 have answered and returned the questionnaire in due time. Therefore, the results of the survey should be considered with precaution.

Nevertheless, comments presented above give a general idea on the Staff Mobility activities performed during the past two academic years (2003/04 and 2004/05).

The results also give a good perspective on the trend of SM, an important part of the general activity developed in the frame of Socrates – Erasmus program.

4 . USE OF EUROPEAN CREDIT TRANSFER SYSTEM (ECTS)

Antal LOVAS, Budapest University of Technology and Economics (Hungary)

4.1 Main goal of the ECTS Questionnaire

The ECTS credits are primarily a workload measure and a planning tool. ECTS is a system for comparing the workload of students across Europe, based on the allocation of 1 (legal) year of study as equal to 60 credits. The idea is that 1 year study is equivalent in all European universities. Unfortunately, at the moment in the field of civil engineering the students' workloads (e.g. study weeks, contact hours, exam period) are not similar at all across Europe.

The initial objective was to make a survey on the civil engineering curricula focusing on the ECTS information.

Secondly we would like to collect the different methods of assessing the credits for the subjects.

Finally we would like to gather information about the grading system.

4.2 Working Methods

First of all a questionnaire was created in order to get the updated information from all institutions by e-mail, as follows:

The answers were shared between the partners, comments or corrections were appreciated. Between the SP8 Task Force Meetings and the Management Committee Meetings the communication was done via e-mails.

Dear EUCEET Member,

please fill this short SP8 Questionnaire in English, change the CITY in the file name (as an example see the attached …_BUDAPEST file) and send back to Prof. A. LOVAS via email until 3rd of June the latest.

E-mail address: alovas@mail.bme.hu

GENERAL INFORMATION			
Name of the Institution	Average of 31 received answers		
City			
Country			
Contact person			
E-mail of the contact person			
Date of completion			
Formal duration		years	
Entry number of 1st year students 2004/05		students	
Do you use the ECTS? (Yes or No)			
ECTS INFORMATION (Please fill if the previous answer is YES)			
Total number of contact hours during of the education		hours/year	
Total number of ECTS credits		credits	
Do you follow the rule 1 ECTS credit = 30 working hours? (Yes or No)			
Subjects where the number of weekly contact hours = number of credits		%	
Subjects where the number of weekly contact hours < number of credits		%	
Subjects where the number of weekly contact hours > number of credits		%	
Do you use 0,5 credit? (Yes or No)			
Credits of the fully obligatory subjects		%	
Credits of the specialization subjects		%	
Credits of the fully elective subjects		%	
Length of the semester		weeks	
Length of the examination period		weeks	
Total number of subjects in the curricula			
Number of subjects graded during the semester work (tests, homeworks)			
Average number of subjects/semester			
Average number of weekly contact hours/semester			
Average number of exams in the examination period			
Is a certified foreign language exam required for the diploma? (Yes or No)			
Is there obligatory foreign language subject? (Yes or No)		If Yes:	cr.
Is there obligatory physical training subject? (Yes or No)		If Yes:	cr.
Total number of contact hours of fieldworks		hours	
Total number of ECTS credits of fieldworks		credits	
Total number of days of practical placement		days	
Total number of ECTS credits of practical placement		credits	

If you use ECTS, please share your experience and add any useful information:
What was the method of assessing the credits for the subjects?
Grading system.
Remark (please add here all comments not included in the questionnaire).

4.3 Outcomes

I have received 33 answers:

BE	University of Liege
CZ	Brno University of Technology
CZ	Czech Technical University in Prague
EE	Tallinn Technical University
ES	University of Cantabria
ES	University Polytechnics Catalunya
DE	Technical University of Berlin
DE	Technical University of Darmstadt
DE	Technical University of Dresden
FR	ENPC Paris
FR	INSA Lyon
GR	University of Patras
GR	National Technical University of Athens
GR	Technological Educational Institution of Piraeus
HU	Budapest University of Technology and Economics
IT	Universita Degli Studi di Firenze
IT	Politechnic of Milano
LT	Technical University of Vilnius
LV	Technical University of Riga
NL	Delft University of Technology
NO	Norwegian University of Science and Tecnology
PL	Rzeszow University of Technology
PL	Warsaw University of Technology
PL	Wroclaw University of Technology
PT	University of Beira Interior
PT	University of Porto
RO	Technical University of Iasi
RO	Technical University of Timisoara
S	Chalmers University Technology
SI	University of Ljubljana
SI	University of Maribor
SK	Technical University of Bratislava
SK	University of Pardubice

4.4 Summary of the answers

The received datasheets in table format can be found in the annex, at the end of this report. As a conclusion, the average figures of the given answers are summarized below.

GENERAL INFORMATION	
Name of the Institution	Average of 33 received answers
Formal duration	4,4years
Entry number of 1st year students 2004/05	240students
Do you use the ECTS? (Yes or No)	84% yes
ECTS INFORMATION (Please fill if the previous answer is YES)	
Total number of contact hours during of the education	700hours/year
Total number of ECTS credits	credits
Do you follow the rule 1 ECTS credit = 30 working hours? (Yes or No)	3% yes
Subjects where the number of weekly contact hours = number of credits	44%
Subjects where the number of weekly contact hours < number of credits	31%
Subjects where the number of weekly contact hours > number of credits	25%
Do you use 0,5 credit? (Yes or No)	30% yes
Credits of the fully obligatory subjects	62%
Credits of the specialization subjects	31%
Credits of the fully elective subjects	7%
Length of the semester	15weeks
Length of the examination period	4weeks
Total number of subjects in the curricula	57
Number of subjects graded during the semester work (tests, homework)	19
Average number of subjects/semester	7
Average number of weekly contact hours/semester	25
Average number of exams in the examination period	5
Is a certified foreign language exam required for the diploma? (Yes or No)	53% yes
Is there obligatory foreign language subject? (Yes or No)	67% If Yes:6 cr.
Is there obligatory physical training subject? (Yes or No)	47% If Yes:1 cr.
Total number of contact hours of fieldworks	125hours
Total number of ECTS credits of fieldworks	6credits
Total number of days of practical placement	46days
Total number of ECTS credits of practical placement	4credits

4.5 The method of assessing the credits for the subjects

Generally the subject credits correlate to the number of contact hours. In case of “more sophisticated” subjects or subjects requiring more home work (e.g. design work, complex calculations) the number of credits is increased by one.

Note: in the case of the previous question: Do you follow the rule 1 ECTS credit = 30 working hours? (Yes or No): only 3% of the answers were yes.

4.6 Some special answers see below:

ENPC: 1 ECTS credit = 10 contact hours
MILANO: Quantitative and qualitative importance of the subject
RZESZOW: Resolution of the Faculty Board
TRONDHEIM: 4 subjects per semester: 30/4 = 7.5 ECTS
LJUBLJANA: The students’ opinion was taken into account as an important factor

Grading systems

Using ECTS the recommended grading system is A to F, but the institutions use different scale, see in the table:

	Trondheim	Berlin	Brno	Bratislava
A:	85 – 100 %	95 – 100 %	90 – 100 %	93 – 100 %
B:	75 – 84 %	80 – 94 %	80 – 89 %	84 – 92 %
C:	65 – 74 %	70 – 79 %	70 – 79 %	75 – 83 %
D:	55 – 64 %	65 – 69 %	60 – 69 %	65 – 74 %
E:	40 – 54 %	50 – 64 %	50 – 59 %	55 – 64 %
F:	<40% failed	<50% failed	<50% failed	<55% failed

Some special answers see below:

BUDAPEST: Mark: 5 - excellent; Mark: 4 - good; Mark: 3 - satisfactory; Mark: 2 - passed; Mark: 1 - failed;

MILANO: Quantitative and qualitative importance of the subject

DELFT: 1 to 10, 1 absolutely insufficient to 10 excellent 5 is doubtful, 6 is just sufficient

LIEGE: Grading goes from 0 to 20. 18≤A≤20 excellent; 16≤B<18 very good; 14≤C<16 good; 12≤D<14 satisfactory; 10≤F<12 weak; 7<I< 0 insufficient; E≤7 failure;

RIGA: 10 – outstanding; 9 – excellent; 8 – very good; 7 – good; 6 – almost good; 5 – satisfactory; 4 – almost satisfactory; 3 and less – failed

FLORENCE: From 18 (sufficiency) to 30 (excellent).

In summary, the methods of 33 European institutions show great diversity in the grading systems.

5. THE OPPORTUNITY TO EARN A DOUBLE DEGREE

György FARKAS, Budapest University of Technology and Economics (Hungary)

5.1 Introduction

The significance of the double degree is that the student completes his or her studies required for his or her diploma in two higher education facilities, completing a previously determined portion of the classes at each school. On completion of their studies and successfully defending their diplomas students receive their diplomas from both universities.

The opportunity to obtain a double degree can be realized at a higher level of the bilateral relationship based on the cooperation of the universities. For this it is necessary for the institutions taking part of the program to thoroughly knowledge of each other's training system, program and thematic, and based on personal relationships to acknowledge each other's quality of training .

The advantage of having a double degree is that it makes it easier to prevail in the international job market in the areas of language and professional knowledge. The knowledge obtained at two institutions results in a high level of knowledge of at least two languages, higher mobility, greater openness, wider professional view, and greater adaptability. This is confirmed by careers of the students who have obtained double degrees in the past few years.

Usually the opportunity to obtain a double degree is based on the bilateral contract made between two universities of two different states. When the contract is made the laws of both states regarding the conditions of giving out degrees in the given state have to be taken into consideration. This may determine the minimal time required at certain institutions, the place of the diploma's defence, the setup of the committee present at the defence of the diploma, or other conditions.

There have been bilateral contracts in the Civil Engineering education between European universities concerning the double degrees since the early 1990's. The first such agreements were made between Ecole Nationale des Ponts et Chaussées (ENPC), the ESTICCP Madrid and the University of Aachen. Based on the positive experiences similar connections have been continuously widening between the European universities being part of Civil Engineering education, and nowadays the number of active cooperations and preparation negotiations keep growing. New contracts have been developed with the participation of the Technical University of Civil Engineering Bucharest and the Budapest University of Technology and Economics. In the past decades the opportunity of giving the double degree was made easier greatly by the continuous spread of the credit system (ECTS) introduced at the universities of the European region.

The international bilateral contracts concerning the opportunity to obtain double degrees are usually in effect – according to the previously determined conditions – until one of the parties steps back. Contracts determine the length of the program, and usually what part of the program has to be spent at certain institutions, the conditions of accepting one's studies, and financial requirements.

In case of financing usually the accepting country's tuition for their own nationals are considered standard. Several solutions may be available for the provision of the living expenses of students.

Scholarships given by the European Union, like financing by the Socrates Erasmus program are one possibility. The negative side of this is that it gives a rather small amount of support this way it can only provide for the adequate living of the students with other support, besides that the length of support is limited as well.

Another possibility is scholarships given by either the sending or the accepting institutions or both. However these are only available on very limited numbers and only for the most excellent students

The companies of the older member states of the European Union are mostly interested in the scholarship support of the students participating in the double degree programs form the countries that newly joined to the EU. This setup is beneficial to both the students and the companies as well. In this case the amount of the scholarship usually provides adequate living standards for the students. On the other hand the students who get in touch with the companies become more open to solving practical problems, and in this setup companies can find the new generation of professionals from the joining countries with local knowledge and experience from the company as well.

Most attention must be paid to the reconciliation of the different programs when organizing the double degree programs. In this regards the different training thematics, the different credit values of certain classes, and in certain cases the different systems and lengths of programs may be sources of problems. In this regard the proper caution must be used when developing the contracts, which should be individually prepared, paying particular attention to what the given degree entitles the graduate for in the two participating countries.

As conclusion we can consider that in spite of this difficulties the possibility to have a double degree is a good opportunity for students and even for institutions to develop the relationships between universities. That is why taking all this into consideration it is advisable to increase the future number of international dual degree contracts for the realization of expected advantages.

As an example the contract between the ENPC and BME is added.

5.2 Double degree Program established by Ecole Nationale des Ponts et Chaussées and The Budapest University of Technology and Economics

For a long time there has been a fruitful cooperation between the Ecole Nationale des Ponts at Chaussées (ENPC) and the Budapest University of Technology and Economics (BME). Based on this success the two institutions decided to establish a program that gives the students the possibility to earn a double degree with the following title: Okleveles építőmérnök BME Építőmérnöki Kar and Ingénieur de l'Ecole Nationale des Ponts et Chaussées.

5.2.1 Program conditions regarding the students of BME

After finishing the third year of the sample program the students of BME gain acceptance to the second year of ENPC like the students accepted based on their earlier studies.

The students have to successfully finish the science, professional and language classes of the second and third years and they have to do a short term (two months) or a long term (one year) internship between the second and third years. In their fourth semester at ENPC the students have to prepare their graduation project.

Students defend their diploma project at BME at the presence of a representative of ENPC. At the same time students have to take their graduation exams in French as well.

5.2.2 Program conditions regarding the students of ENPC

The students of ENPC gain acceptance to the fifth year of BME after successfully finishing their second year and their short or long term internships.

They have to successfully graduate from the fifth year classes of the sample program by collecting 30 credits and they have to prepare their diploma projects. Students defend their diploma project at BME at the presence of a representative of ENPC.

5.2.3 Selecting the students

The students participating in this program are chosen by the two institutions together. BME selects the institute of ENPC where the chosen student belongs to based on his or her specification. In the first phase of the realization of the program, both institutes maximize the number of students at five people.

5.2.4 Taking care of the students

The guest institute appoints a teacher for every student to help him or her throughout the entire program. For the BME students studying at ENPC this teacher is the head of the chosen institute of ENPC. For the students of ENPC studying at the BME this teacher is the one responsible for the civil engineer department of the French Division.

5.2.5 Giving out the two diplomas

The participating students of the double degree program will receive the two diplomas at the same time.

5.2.6 Tuition and expenses

Students pay their tuition at their home institute. Additional expenses (student housing, books, etc.) are paid by the students according to the regulations of the host institute.

5.2.7 Contract enacting and term

This contract comes to force as soon it is signed by the heads of the two institutions. The contract is for five years and after the first five years it is automatically extended unless one of the parties officially backs out six months earlier. Those studies in progress are not affected by the termination of the contract.

6. Conclusions

The work completed within the framework of the SP8 working group made it possible to characterize the activities of student and staff exchange in the field of civil engineering higher education, in Europe and sometimes outside Europe.

Concerning staff mobility, it appears that if the academics have many contacts, through different networks and through their research activities, the possibilities of mobility offered within the Erasmus Socrates framework are not much used, and in a very unequal way. This is confirmed by the fact that only a few universities answered to the questionnaire on staff mobility. Moreover, these answers show a dramatic decrease of the academic mobility activity in 2004/05 compared to 2003/04. When it is possible, the academics prefer to mobilize other resources allowing them to visit the foreign universities and partners with fewer constraints.

Obligation of teaching, if it does not pose a problem of principle for the academic who moves, appears often very complex to organize for the university which receives, for reasons of timetable, availability of the students, and synchronisation of the teaching activity with the courses proposed by the visiting academic.

Concerning student exchanges, it appears that all the institutions which answered to the survey, actually develop these exchanges and set up specific structures of management.

The importance of the exchange activity can be partly evaluated through the number of agreements signed by a university and also by the percentage of students having made an exchange during their curricula. If, considering these two criteria, the average level appears very good, one notes however strong disparities: on average, each university signed 28 agreements, but some universities have less than 10 agreements, while others have more than 60. And these agreements mainly relate to 4 countries (Germany, Italy, Spain and France and to a lesser extent the United Kingdom, Portugal, Sweden and Austria), the other countries appearing only for less than 20 and sometimes 10 agreements.

This survey showed also that only a quarter of the universities have an approximately balanced exchange activity: most of them present a strong deficit in incoming students (with a ratio of incoming students /outgoing students < 0.5), some few universities having an imbalance in opposite direction (with a ratio of incoming students /outgoing students > 3).

The level of mobility (percentage of students having carried out mobility equal or higher than three months) is also very variable, ranging from some percents to more than 70%.

The financial support to compensate for the over cost for studying abroad is generalized, in particular through the Socrates program. Very often the Socrates support is also supplemented by grants allotted by other national or regional institutions.

The important differences in mobility can be partly explained by language and financing problems or differences:

- Concerning the languages, it is obvious that the countries whose language is more widespread have more facilities to attract foreign students. The development of courses taught in English in many non English speaking countries should undoubtedly facilitate the exchange activities. However it is necessary to avoid that the students hosted in such curricula give up learning the host country language, which would reduce considerably the potential richness of these stays abroad.

- Concerning the financing, the differences in standard of living between the various countries poses considerable problems still not satisfactorily solved: the over cost can be in some cases much higher that the average salary in the home country. A solution promoted by the Czech Technical University of Prague could be helpful in some cases, each student paying the costs of study, of housing and food in his home university.

The exchange activity can also be slowed down by the problems of recognition of the subjects studied during the stay abroad. If this recognition must be based on very rigorous criteria and organisation, in order not to devalue this activity, a too strong rigidity, in particular on the detail of the contents can lead to lengthen the duration of the studies, thus constituting a brake for the exchanges.

In this context, the very broad adoption of European Transfer system (ECTS) highlighted by the survey that we realized constitutes an unquestionable progress. But It remains that the application of these rules is rather variable. A certain flexibility is incontestably needed to preserve the originality of the teaching approaches, source of richness for the exchanges. However, from the point of view of the student, clear rules are essential so that its curricula abroad can be precisely recognized.

Lastly, our group also has noticed the development of Double degree agreements. In a context of recognition of engineering degrees all over Europe, one can wonder about the interest of these agreements which lead to lengthen the duration of the studies. In fact, this recognition is not yet complete and in certain particular cases, the double degree can be an interesting solution. However, apart from this particular case, the interest of a double degree agreement is that it requires a thorough knowledge of the partners, thus constituting a good base to develop further collaborations.

ANNEXES

1. REPORT ON STUDENT EXCHANGE CTU IN PRAGUE, FACULTY OF CIVIL ENGINEERING

Václav Kuraz, Czech Technical University in Prague, Czech Republic

1.1 Policy of student exchange

CTU in Prague supports any type of student exchange. For the BSc. study period the exchange (1-2 semesters) is possible (after closing 1st study year), for MSc. Study period 1 semester of study abroad is recommended. For students of PhD. program the study stay abroad (at least 3 months) is compulsory.

The main obstacle for exchange is still not adequate knowledge of foreign language, but the situation is improving.

1.2 Administrative management

The administrative management of exchanges is mainly organized at university level by International Office. Since 2003 the European Office as a part of the International Office has been established to be responsible for managing of student and staff mobility in the framework of EU countries.

The main activities of the “EO” concerning student exchanges are following:

Administrative relations with the ERASMUS office

Administrative relations with foreign universities(partly it is delegated on corresponding faculties)

General coordination of exchange at the University level

Management of ERASMUS grants

Administrative management of outgoing students

Administrative management of incoming students

1.3 Academic management

The academic management of exchanges is realised at the Faculty level by the ERASMUS coordinator in cooperation with the vice deans for corresponding study branches.

The main activities are:

Academic policy of student exchanges

Selection of students for exchange

Approval of learning agreements

Recognition of study results (Transcripts of records)

Administrative management concerning approval and negotiation with foreign universities (bilateral agreements).

1.4 Types of exchanges for outgoing students

Exchange based on bilateral agreements in the ERASMUS framework.

Non-standard bilateral agreements with non EU countries (USA, Mexico, Canada, Costa Rica, China, Russia) – see attachment

Work placement (not included in our study plans) – Leonardo da Vinci program

ATHENS program – since 2003 we have been full member of the network, at present we offer 4 courses in each semester (on the level of University).

1.5 Bilateral agreements

Bilateral agreements can be signed on the level of Faculty (ERASMUS coordinator) for student and staff exchange from the corresponding faculty only, or on the level of University, than students from different faculties (depending on the subject area code) are eligible to apply.

At present we have approximately 90 bilateral agreements signed on the faculty level, the total number of bilateral agreements (University, Faculties levels) is 279 with 188 foreign universities.

1.6 Financial support

Since the 2004/05 academic year our Ministry of Education offers contribution from its budget up to 350 EUR/month (including the contribution from the EU). Our University management has decided to increase the grant from its budget for 25 EUR/months and the Faculty of Civil Engineering provides another 75 EUR/month from the bursary fund of the Faculty. The total grant is therefore approximately 450 EUR/month.

2. STUDENT EXCHANGE CTU IN PRAGUE WITH NON EUROPEAN UNIVERSITIES

Václav KURAZ, Czech Technical University in Prague (Czech Republic)

2.1 Standard agreement

Universities with whom we wish to establish an agreement on student exchanges often send their "standard agreement", under which

Tuition is waived

The students of each partner university are responsible for their own travel expenses, health insurance, board and accommodation.

Unfortunately, the terms of this "standard agreement" are normally not acceptable to CTU in Prague for the following reasons:

The cost of living at the partner university is likely to be much higher than for a student in Prague. The costs are so much higher that our students are unable to take up the study opportunity, so there will be no sustainable exchange of students.

Salary levels in the Czech Republic remain low, and families are not able to support the living costs of a student in an expensive city.

Students in Prague benefit from subsidized accommodation, transportation, board, etc., which may not be available to them at the partner university. It is therefore difficult to justify the offer of subsidized facilities for students from the partner university.

2.2 Non standard agreement

CTU is interested in establishing sustainable agreements with partner universities on exchange of students. The "non-standard" formula that we have used with success with partner universities in the USA, and also in less expensive countries such as Mexico and Russia (Siberia) is as follows:

Tuition is waived

The students of each partner university are responsible for their own travel expenses and health insurance

Outgoing students pay the cost of board in a student canteen and accommodation in a student hostel at their home university.

This formula is non-standard, and involves some extra administration. However, it has the important advantage that it makes the exchange programme sustainable. It not only makes the costs manageable for Czech students; it also defines the basic costs, and ensures the students, their families and CTU that the student will not live in poverty or acute financial embarrassment.

The International Office of the Czech Technical University in Prague has used this "non-standard formula" with considerable success, and recommends it to all faculties and institutes of the university, and to prospective partner institutions.

2.3 List of non European universities having the agreement with the CTU:

Kansas State University (KSU), Manhattan, KS, http://www.ksu.edu
Union College, Schenectady (UC), NY, http://www.union.edu
Milwaukkee School of Engineering (MSOE), Milwaukee, WI, http://www.msoe.edu
University of New Orleans (UNO), New Orleans LO, http://www.uno.edu
Krasnojarsk state academy http://www.sibsau.ru
Krasnojarsk state technical university http://www.kgtu.runnet.ru
Krasnojarsk state university http://www.lan.krasu.ru
Krasnojarsk state architectural and Civil Engineering academy
http://www.kgtu.runnet.ru/vuz/kgasa3.htm
Tomsk Polytechnic Institute, Tomsk http://www.tpu.ru
Instituto Tecnologico de Estudios Superiores de Monterrey, Mexico
CREPUQ – Conférence des Recteurs et des Principaux des Universités du Québec, Canada.

3. REPORT ON STUDENT EXCHANGE - INSA LYON, CIVIL ENGINEERING AND URBAN PLANNING DEPARTMENT

Richard KASTNER, Institut National des Sciences Appliquées de Lyon (France)

3.1 Policy for student exchange

3.1.1 Policy at INSA level+

INSA has a strong policy concerning foreign language and student exchange: all the students must have a good standard in one foreign language and an acceptable standard in a second one. The objective for exchanges is that 70 to 80% of students should have a significant stay abroad (3 months or more).

In some departments, a stay (stay for study or work placement) is compulsory.

INSA tends to develop a large policy of bilateral agreements with high level Universities all over the world, and to participate to some global exchange programs.

In order to promote this policy, an "INTERNATIONAL DAY" is organised every year with the presence of representatives of foreign partners, general presentation on the possibilities of exchange periods and the possibilities of financial support.

3.1.2 Situation in the Civil Engineering and Urban planning Department

Exchange periods are not compulsory but are highly recommended. The students can do their fourth year, fifth year or final year research project in a partner university abroad. A working placement in a foreign country is also possible.

During the last five years:

About 50% of the students had a full year exchange

About 10 to 15% of students have done their final year project abroad

About 10 to 15% of students have done their Work Placement abroad

For the GCU department, the exchange balance between incoming and outgoing students is usually fair.

3.2 Administrative management

The administrative management of exchanges is mainly realised at the INSA level, for all 10 departments, by an international office (Direction des Relations Internationales - DRI), in collaboration with the Department teams in charge of international relations.

The main activities of the "DRI" concerning student exchanges are the following:

Administrative relations with Erasmus-Socrates office

Administrative relations with foreign universities and networks

General coordination of exchanges at INSA level (10 departments)

Management of Regional and Socrates-Erasmus grants

Administrative management of outgoing students (to collect and transmit the files…)

Administrative management of incoming students (registration, accommodation…)

3.3 Academic management

The academic management of exchanges is mainly realised at the department level, by an academic in charge of international relations and a part time secretary. The management of work placements in foreign countries being coordinate by the person (academic) in charge of work placements in the GCU department.

The main activities of the department office for student exchange are the following:

For outgoing students

Academic policy of student exchanges

Selection of students for exchanges

Advice for study plan and approval of Learning Agreement

Academic follow up of the students during their stay abroad

For incoming students

Selection of incoming students

Welcome of incoming students and advice for study plan

Approval of Learning Agreement

Collection of academic results and transmission to the home university

3.4 - Types of exchanges for outgoing students

For INSA GCU students, there are 4 types of exchanges possible

Full 4th year

Full 5th year

Final year project (4 months - 5th year)

Work placement (3 to 5 months between 4^{th} and 5^{th} year)

3.4.1 Full 4th year

2 semesters (1 semester not allowed)

55 to 60 (65) ECTS credits

Full year recognition

Maximum number of outgoing students : ~25 (/100)

Selection by an interview (based on motivation, academic results, language)

Learning agreement

Compulsory subjects

Probability/statistics

Advance structures

Soil mechanics/geotechnical engineering

Reinforced concrete

Steel structures

Heating / air conditioning

+ Optional subjects

⇨ total of 55 to 60 ECTS credits

3.4.2 Full 5th year

2 semesters (1 semester not allowed)
55 to 60 (65) ECTS credits
Maximum number of outgoing students : ~25
Full year recognition
After his year abroad, the student has to present his curricula and his final year project to a tutor

Learning agreement
40 to 45 credits of courses (4^{th} and 5^{th} year level)
+ final year project (15 to 20 credits)
No compulsory subjects :
The student chooses high level subjects in the general field of civil and environmental engineering, and urban planning. The final year project must be agreed by an INSA supervisor
⇨ total of 55 to 60 ECTS credits

3.4.3 Final year project (PIRD)

The final year project is a 4 to 5 months (May to September) R&D type project, done in a research laboratory. This project can be done in a research laboratory in a foreign university, but in relation with an INSA laboratory.

This project is assessed in both universities (abroad and INSA) on the basis of a dissertation and an oral presentation

Due to organisation constraints, 12 students maximum are authorized to do this project abroad.

3.4.4 Work placement

The compulsory work placement (3 to 5 months between 4th and 5th year) can be done abroad.

3.5 General remarks

For study periods, 1 semester exchange is not allowed. This is due partly to the annual organisation of the studies at INSA, but also because we consider that there is a minimum time needed for adaptation (language and ways of teaching) that makes one semester exchange not very effective.

Students have often difficulties to find all compulsory subjects during their exchange period: in that case, they may have to study themselves the subject and are then assessed by INSA, generally on the basis of a personal work and an oral examination.

3.6 Bilateral agreements

More often, bilateral agreements are signed for all INSA departments, but in some cases, under the frame of this general agreement, specific agreements are signed by specific departments, essentially to determine the maximum number of exchange students.

3.6.1 Bilateral agreements in Europe

The INSA GCU Department is involved in approximately 40 bilateral agreements in Europe:

Germany (6), Austria (1), Belgium (1), Spain (8), Finland (1), U.K. (5), Hungary (1), Ireland (2), Italy (3), Lithuania (1), Norway (1), Portugal (3), Romania (1), Sweden (3), Suisse (2), Czech Republic (1)

The destinations chosen by the students are varying largely, but English, Spanish and German speaking countries are the most popular. Generally, there are enough places in each country.

3.6.2 Bilateral agreements outside Europe

The INSA GCU Department is involved in approximately 40 bilateral agreements outside Europe but also in some networks:

Australia (3), Brazil (4), Canada (8 + network), Chile (2), Chine (1), South Korea (1), India (3), Japan (1), Mexico (3), Singapore (2), U.S.A. (3 + networks), Venezuela (1)

There is a great difficulty to achieve a fair balance with English speaking countries, (Australia, USA, Singapore); thus places in these country are too limited compared to the students first choice.

3.7 Financial support

When applying for an exchange, students have to pay specific registration fees of about 200€. Part of these fees is used for the expenses of the DRI and the International offices of the departments, the rest being assigned to a “solidarity fund”.

Until now, all the students have a financial support for their exchange:

Socrates-Erasmus grant

Regional council (BRFE)

F.S.I. : Solidarity Funding for student exchanges

The Financial support is about 400 to 500 € per month

Report of the
Working Group for the
Specific Project 9

Enhancing the attractiveness of the civil engineering profession

ENHANCING THE ATTRACTIVENESS OF THE CIVIL ENGINEERING PROFESSION

François Gérard Baron[1], Ralf Reinecke[2], Colin J. Kerr[3]

1. INTRODUCTION

In deciding on the main issues to be considered during the second phase of EUCEET, the Management Committee had proposed that a working group be established to consider ways to enhance the attractiveness of the Civil Engineering Profession. This presupposed that there was a problem about the attractiveness of the Profession, a proposition which had been raised in a number of formal and informal discussions during the earlier phase of EUCEET, and which had been manifested in a number of ways. These included strong impressions in some quarters that the numbers of students applying to study civil engineering were declining, that companies were having difficulty attracting and retaining good staff and that civil engineering as a Profession was seen in a much less positive light that professions such as architecture, law, medicine and so on.

The Management Committee appointed François Gérard Baron, a senior member of CNISF, to chair a Working Group to consider this matter. The Working Group was inaugurated at the General Assembly held in Athens in February 2003. The terms of reference are summarised as the aim to provide guidelines to universities and the profession in order to enhance the attractiveness of the Engineering Profession in general and Civil Engineering in particular. Working methods would consist of surveys of and interviews with young students.

The Working Group began its deliberations at the Athens General Assembly. In an open forum, data from the United Kingdom was presented and a number of propositions were made, primarily as a stimulus to discussion, suggesting that there was a serious decline in the number of applicants to study civil engineering, that there was a problem with the public and professional image of civil engineers in the UK, which took the following form:

- Lack of interest and knowledge amongst the young
- The best and brightest choose subjects other than Civil Engineering
- The general public don't respect engineers, especially Civil Engineers
- The work of Civil Engineers is associated with problems rather than solutions
- Civil Engineers are associated with environmental damage
- The work is difficult and not glamorous
- The work in highly responsible and not commensurately well paid

A number of reasons were proposed as to why this might be the case, including:

- Engineers don't explain themselves very well
- They are seen as dull, non-committal and evasive

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- They give the impression that everything can be calculated and explained, when this may not be the case
- The general public do not understand what Engineers do and what they contribute to society
- There is currently a perceived anti-technological bias in the UK
- Engineering is seen as a dirty and non-glamorous profession

It was also suggested that the problem, such as it may exist, could lie in many sectors, including Industry, Engineers themselves, the general public, politicians and the education sector. This apparently sweeping and critical statement about the state of the Profession, at least in the UK, attempted to pose some difficult questions rather than offer detailed analysis applicable to all countries.

It became clear during the debate that the scenario set out above was not representative of all countries in Europe. While it might be true of the UK, representatives from several other countries, particularly in southern Europe, felt that Engineers were widely respected and valued as professionals. Thus one of the first aims of the Working Group, in addition to those set out by the Chairman, would be to assess the current situation in the various EU countries, to see whether there really was a problem of lack of attractiveness of the Profession across Europe, since proposals to enhance its attractiveness would depend on the extent to which this was needed in the different countries.

2. OUTLINE OF WORKING METHODS

Attractiveness is very much about what other people think about us, not about how we perceive ourselves and our discipline. We are well used to seeking views and finding out information from the relatively captive audience comprising Civil Engineers, whether this be the higher education sector or the Industry. It is inherently very much more difficult to seek the views of others, including students not interested in studying our subject, the general public, politicians, other Professions and so on, yet it is precisely these people who are likely to be less aware of or well-disposed towards Civil Engineering. In deciding how to tackle the problem of collecting information we were very much aware of this, though not entirely clear how best to go about getting useful and statistically valid data. This said, we approached the problem in a number of ways.

2.1 Is there a problem?

The first task of the Working Group would be to try to obtain a snapshot of reasonably well informed opinion in each country, to try to understand the extent to which there was or was not a problem. This would be done by studying existing published material to assess current perceptions, and looking at views of young people, recruitment to university courses, skills shortages, salaries of other professions and possible solutions where problems had been identified. A short template relating to these points was drawn up and members were asked to write a similar short summary of the situation in their own country, based on the same headings.

Unfortunately, we only obtained a limited number of replies from members when they were asked to prepare a status report along the lines indicated above. We therefore took a different approach, which involved asking members of the ECCE Education Task Force to reply to a much shorter and more concise questionnaire, which aimed to give us a snapshot of the status of Civil Engineering in their countries. This proved much more successful. We obtained 14 responses which, when taken with the replies we had to the template approach above, gave us a good picture of the status of the Profession across Europe. Templates and questionnaires are set out in Appendix A: Status Reports and Questionnaires Giving a Snapshot of Views of the Profession in Europe.

2.2 Views of school pupils

The second approach would be to conduct surveys of school pupils preparing to go to university, to try to understand what they think and what they know about the Profession, and about courses in civil engineering. EUCEET members were asked to conduct surveys of local schools. One perceived difficulty here was that universities might tend to be linked with those schools which were well-disposed towards and reasonably well- informed about engineering, which might bias results in favour of our discipline. Bearing this in mind, the Group drew up a short questionnaire for school pupils, which was circulated to all university members of EUCEET. Appendix B includes the questionnaire and the data collected from school pupils.

2.3 Views of new university students

The third approach was to conduct surveys of first year students, to assess their perceptions. In some cases, members would only have access to civil engineering students, or perhaps to engineering/science students, and while this would provide interesting results, it could be more helpful in assessing the extent of the problem to seek the views of a wider range of students. Nonetheless, we did what we could to collect views from as wide a range of students as possible. Appendix C includes the questionnaire and the data collected from first year university students.

2.4 National Statistics

It was also felt that the collection of national statistics relating to university entrance, size of the Industry and other factors would be helpful. We attempted to gather these via our colleagues in the Education Task Force of ECCE. However, this proved very difficult and time consuming, and the material we did collect gave a very incomplete picture, so we did not consider it appropriate to pursue this approach.

2.5 Data Analysis

This began as a manual operation, undertaken by one person, to ensure uniformity of interpretation, and data is presented in a series of tables in

Appendices B and C. However, part of the way through the project, the decision was taken to analyse the data electronically. Spreadsheets and graphics were prepared for schools data and these proved very helpful in interpreting the results. These are also presented in Appendices B and C. The difficulty, as ever, was that of collecting data from a wide range of countries and universities, and in persuading colleagues to undertake the non-trivial task of loading data from large numbers of questionnaires into the spreadsheets so that the results could be analysed electronically. We have tried hard to collect and much information, have presented everything which is available to us and have drawn conclusions from this material, mindful that it is not a perfect set. Time did not permit the same analysis for the data on first year students, so we relied on manual interpretation. Our view is that despite any shortcomings, this still gave us a reasonably good picture of the situation.

3. ANALYSIS OF RESULTS

3.1 What is the Current Status of Profession in Europe?

The text below is based on replies from the national representatives of 14 EU countries.

Eight questions were posed and respondents were asked to give considered answers based on their knowledge and experience of the scene in their country, based on their perspective as ECCE national representative. An analysis of each question is given below.

3.1.1 Is the number of students studying civil engineering in your country declining?

9 countries (64%) said no and 5 (36%) said yes, though of those saying yes, Portugal added that the downturn was small, and of those saying no, Lithuania pointed out that there had been a downturn in the more traditional area of structural engineering which had been balanced, in terms of numbers by increases in other specialisations.

3.1.2 Is the academic level of students entering civil engineering courses in universities in your country declining?

Eleven countries (78%) said no, 3 (22%) said yes, though one of the 11, Finland added that there had been a decline in the recent past, which had now been reversed.

3.1.3 Is the number of students wishing to enter the Profession in your country declining?

Eleven (78%) said no, 3 (22%) said yes. Of those saying no, Finland, Latvia and the Slovak Republic said that this had been a problem in the past. Of those saying yes, Portugal said that this was a really serious problem. Spain added that there was a particular difficulty for companies to find certain specialisations.

3.1.4 Is the general academic level of students entering universities in your country declining?

Nine said no, 5 said yes (64%/ 36%). Of those saying no, Finland noted that there had been a problem in the past. Once country, Greece, said that it varies according to discipline.

3.1.5 Is the Profession satisfied with the quality and quantity of its members?

Five countries (36%) said yes, 3 (21%) said no, 4 (29%) reported shortages in certain specialisations and 2 (14%) said that while the quantity was satisfactory, the quality of engineers was sometimes a problem.

3.1.6 In cases where the Profession is not satisfied, what are the main reasons for this?

Four countries (29%) said the situation was satisfactory, though one of these, Estonia, said that the poor salaries of academic staff meant that there could well be serious difficulties in the future due to the lack of people to train the next generation of engineers. Four countries (29%) reported difficulties with a lack of certain technical competences amongst engineers and two (14%) reported that engineers had low status compared to other Professions such as lawyers and doctors. However, the main problem, reported by 64% of countries was the poor level of salaries for Engineers.

3.1.7 What is your country doing about these problems?

Two countries made no specific responses, but of those that did, a number of themes emerged. Several countries, including Finland, France and the Slovak Republic, stressed the importance of good publicity and marketing, while related to this point, Germany underlined the importance of demonstrating how important engineers are to society. Poland, Turkey and Greece talked about the need to lobby government and to press for simpler legal procedures, while a number of countries stressed the need for academe to work with Industry and the Professions.

3.1.8 What is your organisation doing to promote civil engineering amongst young people?

A number of ideas were put forward. Greece, Latvia and Lithuania commented on the importance of open days and school visits, France and Estonia promoted the cause via prizes, and several countries, including France , Finland, Spain and Turkey organise conferences and media events. Others, including

Poland, Latvia, Estonia, Finland and Greece talked about promoting the achievements and innovations of Civil Engineers more widely in the public arena.

3.2 Analysis of Schools Data

Data was collected from 20 groups of students from 16 different countries, who were contacted by universities within the EUCEET network. School pupils were asked whether certain factors had influenced their decisions about courses of study at university, and whether they agreed with certain propositions about Civil Engineering courses and the Civil Engineering Profession. They were invited to tick as many boxes as they wished, but were not required to take a view on every proposition. For each group of students, the percentage of 'votes' for each factor was tabulated, so it was possible to form a view of the extent to which each group agreed with a given proposition. The rankings of the propositions relative to each other gave an indication of the importance of each factor. The votes were also averaged for all groups, in order to gain some idea of the agreement and importance of each factor across the survey as a whole. Raw data is presented in Appendix B.

At the outset, we hoped that we might get some idea of differences between school pupils favourably inclined towards engineering and those not particularly interested in it. In some cases this worked and the graphical treatment of results does show these differences. In others, it was more problematic, because a number of universities have contacts primarily with those schools where pupils are already favourably inclined towards engineering. Having said this, a summary of results is given below, with pupils inclined towards engineering being termed 'engineers' and those not particularly interested in engineering termed non-engineers'.

Factors Influencing Choice of University Study

3.2.1 Perceived Attractiveness of the Profession

Of seven possible factors, the tables show that 27% of the votes related to the perceived attractiveness of the profession which the school pupils hoped to enter and graphical analysis indicated that 70% of students selected this factor. This factor was clearly very important in pupils' thinking, and in the case of Barcelona for example, it was the most important factor.

3.2.2 Cultural Interest

This factor gained 9% of the votes and 25% of Engineers selected it, compared to 21% of Non-Engineers. In general, it was of middling to low importance compared to other factors. In the case of Torino and Turkey, it was somewhat higher than average.

3.2.3 Prestige of the Profession

This factor gained 16% of votes, and 40% of Engineers cited it, compared to 30% of Non-Engineers. On average, it was the second or third most important factor though Poland and Cyprus, rated it lower than average.

3.2.4 Possibility of High Salaries

This factor gained 20% of the votes and was cited by 46% of engineers compared to 40% of Non-Engineers. On average, it was rated top or second in the list, and though engineers were generally more concerned about this than Non-Engineers, the reverse was the case for the UK and Torino, while for Barcelona and Cluj, there was no real difference.

3.2.5 Ease of Studies

This factor got 4% of the votes and there was virtually no difference between Engineers and Non-engineers. It was not considered to be an important issue.

3.2.6 Short Duration of Studies

This was even less important that ease of studies. It got 2% of the votes and there was no difference between Engineers and Non-Engineers.

3.2.7 Suggestions from Parents or Friends

This factor gained 9% of the votes and was more important in the case of Non-Engineers (31% compared to 20%). There was a wide difference of view about whether this was an important issue. Some groups, such as Pardubice and Delft rated it second, while others, such as Portugal, placed it sixth.

Pupils' Views of Civil Engineering Courses

3.2.8 Tedious Courses

This view gained 9% of the votes, and there was a slight tendency for Non-Engineers (11% compared to 9%) to agree with this proposition. However, on average, the proposition that Civil Engineering courses are tedious is not widely supported.

3.2.9 Useful for Practical Applications

This factor gained 27% of the votes and was much more heavily supported by Engineers compared to Non-Engineers (50% compared to 22%). Most groups of students rated this factor as top or second in importance.

3.2.10 A Difficult Subject

This factor gained an average of 25% of the votes, and was considered to be the case by 27% of Engineers compared to 37% of Non-Engineers. There was quite a spread of views about the importance of this factor compared to the others, but three groups placed it top and 1 second.

3.2.11 An Interesting Subject

This factor gained an average of 20% of the votes and was supported, perhaps not surprisingly, by 47% of Engineers compared to 19% of Non-Engineers. On average, it was considered to be of middle to high importance.

3.2.12 An Easy Subject

This gained only 2% of the votes, meaning that it was not perceived as an easy subject. Even Engineers did not see it as an easy subject, though Non-Engineers were even less inclined to agree (2% compared to 5%). Even so, it was not considered to be an important consideration compared to the others

3.2.13 I Don't Know Much About Civil Engineering

This received an average of 19% of all the votes. 19% of Engineering-inclined students also agreed, but this figure was outweighed by the average of 49% of Non-Engineers who agreed with this proposition. This was the top factor for three groups.

Views about the Civil Engineering Profession

3.2.14 Civil Engineering is Responsible for Environmental Damage

This got an average of 6% of the votes, and was also cited by an average of 6% of Engineers, though the figure for Non-Engineers, at 15%, was much higher. Most groups considered this to be of middling to low importance compared to other factors.

3.2.15 A Difficult Job, Not Well Paid

This received 7% of the votes and was cited as a factor by 5% of engineers compared to 12% of non-engineers. Most groups placed in low in the list or factors and 8 placed it bottom. Thus the general view was that this proposition was not supported.

3.2.16 *Gives the Impression that Everything Can be Calculated and Explained*

This got 14% of the votes and was cited by 22% of Engineers compared to 19% of Non- Engineers. In general, groups place this factor high in their lists compared to others, from which we conclude that this proposition is generally supported.

3.2.17 *Useful for Remediating Environmental Damage*

This factor received 9% of votes and was supported by 22% of Engineers compared to 11% of Non-Engineers. However, it did not rate particularly high compared to other factors, suggesting that pupils did not see Civil Engineering in this way.

3.2.18 Useful for Solving Practical Problems

This received 32% of votes and was supported by 57% of Engineers compared to 32% of Non-Engineers. Most groups placed this high on their lists and many placed it top. Thus is widely seen that Civil Engineering is useful for solving practical problems.

3.2.19 I Don't Know Much About Civil Engineering

This gained 15% of votes and was supported by 40% of Non-Engineers, compared to only 17% of pupils favourably-inclined towards Engineering. Four groups place it top of their list and 4 placed it second, so this was considered to be quite an important factor.

3.3 Analysis of University Data

Factors Influencing Students' Choice of University Course

Students were offered a number of factors which might have influenced their choice of course at university and asked to say whether these were very important, important, neutral, less important or not at all important. In analysing the results, very important and important were grouped together, as were less important and not at all important. The remainder were neutral. Raw data is given in Appendix C, and this is summarised below.

3.3.1 Cultural Interest

On average, 47% of respondents said that cultural interest had been an important or very important factor in making their choice of university course, while 21% said that this had been less important or not important at all. There was a fairly wide spread around the average, of 47%, with Italian, Turkish and Czech universities going as high as 60-90% (ie. Important/very important) and Estonia and UK going as low as 20-24% (not important)

3.3.2 Prestige of the Profession

On average, 67% of respondents said that the prestige of the Profession was an important or very important factor in their choice, while 10% said that this was less important or not important at all. The spread around these averages was small. There were two exceptions; in Prague the majority view on this was neutral and in Denmark, the spread was even across all categories.

3.3.3 Attractiveness of the Profession

An average of 77% of respondents said that this factor was important or very important, while only 6% said it was not. There was good agreement between countries, except in the case of Portugal, where the majority were neutral on this point.

3.3.4 Possibility of Earning High Salaries

70% said that this was important or very important, while only 7% disagreed. Again, there was good agreement between countries, except in the case of Delft, Holland, where one third felt that this was important/very important and 40% were neutral, and Portugal, where one third said it was important and two thirds were neutral.

3.3.5 Relevance to the Public Interest

On average, 43% rated this as important/very important, while 18% said it was less important or not important at all. There was quite good agreement between countries, though Portugal and the Slovak Republic were less inclined to see this as an important factor.

3.3.6 Easiness of Studies

An average of 9% considered this to be an important or very important factor, while 56% said that it was not. There was good agreement between countries

3.3.7. Short Duration of Studies

Again, an average of 9% considered this to be important or very important, while 63% did not. There was good agreement between countries, except in the case of Timişoara, where the opinion was reversed.

3.3.8. Suggestions by Parents and Friends.

An average of 21% said this was important or very important, while 52% disagreed. There was good agreement between countries, except in the case of Romania (Timişoara), where the influence of parents and friends was very much higher than the average.

3.3.9. Is Civil Engineering Seen As a Boring Subject?

Whatever their discipline, students were asked to rank civil engineering on a scale of 5 to 1, 5 signifying 'Exciting' and 1 signifying 'Boring'. The average results are tabulated below. Most of the samples were from Engineering students. The difficulty here is that one might expect Civil Engineering students to be supportive of their chosen subject, particularly when they are new to it in the first year of their studies, so the background of the student is potentially important. The way the data were collected grouped all students together, except a in few cases where students were separated by discipline. The first table below includes all students. The second table takes out those groups of students definitely not taking Civil Engineering.

Exciting:	5	4	3	2	1	Boring
%	35.1	25.2	26.8	7.7	5.2	

Exciting:	5	4	3	2	1	Boring
%	44.0	25.6	23.0	5.2	2.2	

In general, the tendency was to see Civil Engineering as exciting rather than otherwise, a trend somewhat more pronounced for Engineering students, Even so, some groups, particularly those from Delft, Barcelona and Tallinn had distributions skewed very much towards the 'exciting' end of the spectrum, while others, such as Firenze, Milano and Timişoara had distributions skewed away from 'exciting' towards the middle of the range.

Students' Views of the Civil Engineering Profession

A number of statements about the civil engineering Profession were made in the questionnaire and students were asked whether they agreed with them or not. This was the case whether or not students were studying civil engineering. Results were grouped into strongly agree/agree, and disagree/disagree strongly, the remainder being neutral. A summary of results for each statement is given below,

3.3.9 Civil Engineering is a Difficult Job

71% agreed or agreed strongly, while only 5% disagreed or disagreed strongly. There was good agreement between countries, except in the case of the UK, where only 41% agreed or agreed strongly while 12% disagreed or disagreed strongly. The Timisoara group also had a relatively high figure for disagreement, at 16%,

3.3.10 Civil Engineering is a Dirty Job

15% agreed or agreed strongly, while 48% disagreed or disagreed strongly. There was good agreement between groups and countries, except in the case of

Turkey, where the ‘agree’ figure was high, at 49% and the ‘disagree’ figure was low, at 26%.

3.3.11 Civil Engineering is not Well-Paid

An average of 14% agreed or agreed strongly, while 46% disagreed or disagreed strongly. There was considerable variation between countries/groups; Timisoara, Turkey and Portugal had higher figures for agreement, while Denmark, Estonia, Cluj and Barcelona had much higher figures for disagreement.

3.3.12 Civil Engineers are Responsible for Environmental Damage

On average, 40% agreed or agreed strongly with this proposition, while 33% disagreed or disagreed strongly. However, there was quite a variation between groups/countries. Italy, Spain and Estonia had much higher figures for agreement, while Cluj, Timisoara and the UK had higher figures for disagreement.

3.3.13 Civil Engineering is a Prestigious Profession

An average of 59% agreed or agreed strongly, while only 8% disagreed or disagreed strongly. There was some variation within the ‘agree’ classification, with Spain, Portugal, Greece and Estonia having very high percentages, with the UK in particular having a low figure. Interestingly, in the cases of Tallinn and Cluj, which separated out engineering and non engineering students, the engineering students had a high figure for agreement and the non-engineers a low figure.

3.3.14 Civil Engineers Solve Infrastructure Problems

On average, 73% agreed with this proposition and only 6% disagreed. There was little variation between groups/countries.

3.3.15 Civil Engineering is a Forward Looking Profession

On average, 61% agreed and 39% disagreed. There was some variation between groups, with Italy, UK and the Slovak Republic well below the average figure for ‘agreement’ and Prague, Tallinn, Greece and Cluj well above the average.

3.3.16 Civil Engineering Uses Advanced IT

Although an average of 46% of respondents agreed or agreed strongly, this covered a wide spread of views, Prague, Greece, Cluj had very high figures for agreement, while Delft, Italy and the UK had very low figures. On average, 12% disagreed or disagreed strongly with the proposition, though not surprisingly, Delft, Italy and the UK tended to disagree much more than the other countries/groups.

3.3.17 Civil Engineering Gives Good Opportunities for International Work

73% agreed or agreed strongly, and 9% disagreed or disagreed strongly. In general, there was little variation between groups/countries, except that the agreement figures for Italy and Timisoara were quite low compared to the average.

3.3.18 Civil Engineering Gives Good Opportunities for Job Mobility

67% agreed/agreed strongly, while 7% disagreed/disagreed strongly. There was good correlation between countries and groups, though Italy and Timisoara had lower figures for agreement and higher figures for disagreement.

3.3.19 Civil Engineering Gives Good Opportunities for Team Work

75% agreed/agreed strongly and 4% disagreed/disagreed strongly. There was agood agreement across the board, except that Timisoara and Greece had lower figures for agreement and higher figures for disagreement.

3.3.20 Civil Engineering Allows for Cooperation with Other Professions

76% agreed/agreed strongly and 3% disagreed/disagreed strongly. These were consistent opinions across the board.

3.3.21 Civil Engineering has Political Involvement

Opinion was split evenly, with about one third agreeing, one third disagreeing and one third not sure. Delft and Barcelona were above average for agreement, while Prague and the UK were below average. 60% of Economics students from Cluj disagreed with the proposition.

4. SUMMARY AND CONCLUSIONS

4.1 Introductory Comments

There are a number of factors which made the collection and interpretation of data for this report more problematic than in the cases of some other projects undertaken by EUCEET. Firstly, it is important to note that this survey collected opinions, not facts and that we were seeking views from those *outside* our main sphere of interest, which makes the collection of representative samples somewhat more difficult. Despite great care being taken in drafting the questionnaires, it became clear when reading them that there had been subtly different interpretations and understanding of English. Sample sizes differed markedly, the largest being a group of 750 students, the smallest a group of 10. Throughout the analysis of data from school pupils and university students, figures refer to groups, not individuals. In one respect, it may have been better to have aggregated all the returns from individual students, but this would have made for a massive job of interpretation for one person, and would have made it more difficult to tease out differences between countries. In retrospect, it would have been wiser to have considered more carefully, at an earlier stage, exactly how data would be processed and analysed. This may have helped in clarifying some issues of interpretation in the questions and made for a statistically more meaningful set of results. The scope of the project proved to be more daunting than we originally envisaged, but nonetheless, and despite some issues over methodology, we believe that we have obtained an interesting and useful perspective on the opinions of young people. We also believe that we have obtained a fair snapshot of the way that the Civil Engineering Profession is perceived across Europe.

4.2 The Current Status

Reports from national representatives suggest hat on the whole, there is no particular downturn in applications to Civil Engineering degree courses and in some cases where there were problems in the recent past, the situation has now improved. On the whole, the academic standards of entrants to courses are holding up well, and in general, enough people are going into the Profession. However, behind this positive picture, there are some less positive trends. There seems to be a downturn or shortage of graduates with certain key industrial specialisations in some countries, with structural engineering and transport engineering being mentioned. There are mixed views about the quality of staff entering the profession even though the overall numbers are thought to be sufficient. In some countries, the quality of staff needs to be improved, while other countries are happy with the current situation. The level of salaries is still seen as a problem, and Engineering is still perceived in some countries as having lower status than comparable Professions.

4.3 Factors which Influence School Pupils

In making their choices about university courses, school pupils are influenced by what they perceive as the prestige and attractiveness of the Profession they hope eventually to enter; the more prestigious the Profession the more likely they are to want to be part of it. They are also highly influenced by the possibility of earning high salaries, though interestingly enough, school pupils do not necessarily think of Civil Engineering as a poorly-paid Profession. Suggestions from parents and friends are not particularly important in the process of choosing a university course. School pupils pay very little attention to the length/duration of their chosen course of study.

4.4 School Pupils' views of Civil Engineering Courses

On the whole, courses are seen as difficult, interesting and useful for solving practical problems, with students not inclined towards Engineering more likely to see them as difficult, boring and tedious. One prominent factor in the survey is that there are many school pupils who do not know what Civil Engineers do.

4.5 School Pupils' views of the Civil Engineering Profession

The Profession is seen as good for solving practical problems and one in which everything can be calculated and explained. This is understandable, but does not accord with the view of Engineers themselves, who are much more likely to see their work as dealing with open-ended problems with a number of solutions, where engineering judgement is an important requirement. This accords with the view that many pupils do not really know what Civil Engineering is all about. The Profession is not particularly seen as one that is responsible for environmental damage, but nor is it recognised as one that can remediate environmental problems either. As indicated above, it is not thought of as a poorly-paid Profession, perhaps because people of this age do not have much experience of the world of work.

4.6 Views of New Undergraduate Students

In general, first year undergraduates see Civil Engineering as prestigious, difficult, forward looking and central to the solution of infrastructure problems. They recognise that it has much scope for international work, job mobility, teamwork and collaboration with other Professions. They are more inclined than school pupils to see Civil Engineers as being responsible for environmental damage. There is no clear consensus on whether Information Technology plays an unusually prominent role; clearly, IT is important, as it is in almost everything these days, but it is not seen as an overwhelmingly important feature. The same applies to the idea of political involvement, by which we mean the extent to which Civil Engineering is influenced by and impacts upon social factors such as provision of public amenities, urban design, financial and political decision making and so on. The Profession is not particularly seen as a dirty or poorly-paid one. Perhaps not surprisingly, Engineering students are more inclined to be supportive of their chosen Profession, while Non-Engineering students are more likely to be anti- or ignorant.

4.7 Conclusions

Debate within the Working Group began with a rather blunt statement of the then situation in the UK, which the talked about lack of interest and knowledge amongst the young, the best and brightest choosing subjects other than Civil Engineering, staff shortages within the Industry, lack of respect for Engineers amongst the general public and a highly responsible and important Profession which was not commensurately well paid. This statement was drawn up partly to reflect genuine problems which prevailed at the time in the UK and partly to stimulate a wide discussion. Given this somewhat gloomy picture, it is very pleasing to report that the situation discovered during this study is by no means as bad as some people feared, and in some cases where there were real problems, it seems as though the situation has improved in the past few years. We can say that in cases where people know about Civil Engineering, their perceptions are often positive. However, even amongst knowledgeable people, there are some worries about the impact that the work of Civil Engineers has on the environment, and some concerns about quality of Engineers working in the Profession. There are also concerns within the Profession about shortages of specialists in, for example, structural engineering and transport. Many practicing Civil Engineers are also concerned about salary levels in comparison to other comparable Professions. No doubt this due in part to their personal experience and aspirations, but the more pressing concern is the one about attracting and retaining staff for the longer term. More widely, there is a good deal of ignorance about what Civil Engineers actually do particularly amongst school pupils making their choice of university course and subsequent career.

A number of ideas of how to improve the situation were suggested, including the following points, and we commend these to the readers of this report, as well as all those who have an interest in securing the future of Civil Engineering as one of the leading Professions of the 21st Century:

- We should take every opportunity to promote and publicise our activities in schools
- We should explain what we do and why it is important to Society as a whole
- We should help to identify and promote prominent Engineers as role models to whom young people can aspire
- We should lobby Government, putting the case for Civil Engineering
- Companies should recognise the importance of paying good salaries as a vital way to attract and retain Engineers.

5. MEMBERSHIP OF THE WORKING GROUP

The work was carried out by a small core team, supported by a much larger group of corresponding/observing members, who collected material and contributed in a number of other ways. Details of contributors are given below.

Corresponding/Observing Members:

Wojciech Bankowski	Road and Bridge RI, Poland	
Dion Buhagiar	University of Malta, Malta	
Luis Simoes Da Silva	University of Coimbra, Portugal	l
Ghislain Fonder	University of Liege, Belgium	
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Jose Maria Menendes	University of Castilla La Mancha, Spain	
Jose F G Mendes	University do Minho, Portugal	
Nicos Nicoleous	Institution of Civil Engineers, Cyprus	
Raileanu Paulica	TU Iasi, Romania	
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Core members:

Carsten Ahrens	FH Oldenburg, Germany
Francois Gerard Baron	CNISF, France
Colin J Kerr	Imperial College London, UK
Diego Lo Presti	Politecnico di Torino, (subsequently Universita di Pisa), Italy
Iacint Manoliu	TUCE Bucharest, Romania
Ralf Reinecke	IB Reinecke, München

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APPENDIX A

STATUS REPORTS AND QUESTIONNAIRES GIVING A SNAPSHOT OF VIEWS ON THE PROFESSION IN EUROPE

A SNAPSHOT OF EACH COUNTRY

A snapshot of the situation in the UK, as in early 2003, was drawn up and offered as template for other countries to follow, in order that we could obtain a comparison of the situation in the various countries in Europe. It was based on publicly available literature and surveys, supplemented by the informed opinions of a number of staff at Imperial College London.

The situation in the United Kingdom

CURRENT PERCEPTIONS OF YOUNG PEOPLE

Engineering is not taught in schools, and many young people do not have a clear idea of what civil engineering involves. It is not seen as an obvious career choice. When asked, school pupils often say that Civil Engineering is boring, dirty, low status and male-dominated, and that the mathematics and physical sciences with which it is associated are difficult. There is also a suggestion that Civil Engineering infrastructure was put in place many years ago, and that Engineers are only concerned with maintenance, not development. Other professions, including engineering professions such as computing, electronics, aeronautics, etc are considered much more glamorous.

There have been times when Civil Engineering has been more popular, particularly when important projects such as the Channel Tunnel and the Thames Barrier were in the public eye, and there is a view which says that good TV programmes can influence young people in a much more positive way.

RECRUITMENT TO UNIVERSITY COURSES

Applications to degree courses halved in the period 1995-2001, and fell by a further 5.3% in 2002. If current trends were extrapolated in a linear fashion, there would be no applicants by 2007! The same downward trend applies to many Engineering and science courses, but Civil Engineering and building courses have been more badly hit that many. Applications to computing science and creative arts courses have increased during the same period, as have applications to new and non-traditional courses, such as sports science, tourism studies, etc.

SKILLS SHORTAGES

This is considered to be a really serious problem. 40% of Consulting Engineering firms have difficulty with recruitment and retention of experienced engineers and many graduate Engineers are not going into the profession, preferring instead to go into others. We are training less technician engineers, and employers are tending not to make best use of these, preferring to employ graduates, even thought they are difficult to find. Shortage areas include transportation, municipal engineering, design, building services and structural engineering, and skills such as business, communications, site experience etc are in short supply. Poor pay is considered to be a major contributory factor, and many engineers feel that they are overworked, underpaid and undervalued.

SALARIES OF OTHER PROFESSIONS (in Euros, at summer 2003)

The best estimate of the average salary of a mid career Chartered Engineer is currently 49.0K euros. Salaries for other professions are generally much higher, for example,

Doctor (General Practitioner)	82.0K
Manufacturing engineer (mid career)	69.0K
Finance Sector (perhaps not even mid career)	174.0K

POSSIBLE SOLUTIONS?

A number of points have arisen from a number of studies and reports in the UK which point to the nature of the problem and some possible solutions. These include:

- Higher salaries, more in line with other similar professions
- Much more activity in schools to explain what civil engineering is all about. This might involve much more activity by companies, and opportunities for pupils to have work experience
- Much more emphasis on mathematics and physical sciences in schools, and better ways of teaching science
- Less boring courses at universities, and more industrial involvement by means of placements, case studies, etc
- More opportunity for creativity in degree courses, and a better balance between creativity and analysis
- Engineers should relate much better to matters of public concern, such as pollution, environmental damage, etc.
- Overcome the overtly masculine image of the profession
- Better public relations by all sectors of the profession

ECCE QUESTIONNAIRES

In the absence of similar reports from other countries, we asked ECCE Representatives to complete a questionnaire, based on their informed opinions rather than detailed analysis. The following results were obtained.

CZECH REPUBLIC

1. Is the number of students wanting to become civil engineers declining in your country?
   No

2. Is the level of students entering the civil engineering schools/universities in your country declining?
   No

3. Is the number of students wanting to enter the engineering profession generally declining in your country?
   No

4. Is the level of students entering the schools/universities in your country declining?
   No

5. Is the Civil Engineering profession in your country satisfied with the quality and quantity of its members?
   More or less yes

6. If the profession is not satisfied, please indicate briefly the main areas of concern (salaries, technical competence, lack of generic skills, lack of specific skills etc).

7. What are the specific actions being taken by your country to overcome any problems you have identified?

8. What are the specific actions being taken by your organisation to enhance the attractiveness of civil engineering profession among young and very young people?

ESTONIA

1. Is the number of students wanting to become civil engineers declining in your country?
   No. The number of students who wanted to be graduated as civil engineers declined from 1990 till 2000 - 2001 and then this number began to increase.
   In 2004 the number of persons (candidates) entering into faculty of Construction of the Tallinn Technical University was 6,17 times higher than there were possibilities for admittance.

2. Is the level of students entering the civil engineering schools/universities in your country declining?
   No

3. Is the number of students wanting to enter the engineering profession generally declining in your country?

No

4. Is the level of students entering the schools/universities in your country declining?
The level of students entering the schools/ universities in Estonia is not declining. But-we have in Estonia a problem of decrease of the number of population (especially children).

5. Is the Civil Engineering profession in your country satisfied with the quality and quantity of its members?
Yes, the Civil Engineering profession in Estonia is satisfied with the quality and quantity of his members. The studying period for civil engineers is now again 5 years in Tallinn Technical University. So we hope that the Civil Engineering profession will satisfy the quantity and quantity during the nearest 10-15 years.

6. If the profession is not satisfied, please indicate briefly the main areas of concern (salaries, technical competence, lack of generic skills, lack of specific skills etc).
We have problems with our professors'/lectures' salaries. Our professors/lectures are aged and we do not have sufficient number of young/ middle aged doctorants, unfortunately.
We try to keep on the normal level of technical competence of our civil engineers through the courses and lectures organized by the Estonian Association of Civil Engineers (EEL).

7. What are the specific actions being taken by your country to overcome any problems you have identified?
We try to overcome the problems we have identified together with the Tallinn Technical University, Associations of Construction Entrepreneurs, Construction Material Procedures, architectural and consulting Engineering Companies and other societies and associations. There is one way to overcome the problem of professors/ lectures - to evaluate the scientific degrees (problem of salaries).

8. What are the specific actions being taken by your organisation to enhance the attractiveness of civil engineering profession among young and very young people?
We started organize special competitions for children during the building fairs connected with some specific building material.

FINLAND

1. Is the number of students wanting to become civil engineers declining in your country?
No

2. Is the level of students entering the civil engineering schools/ universities in your country declining?
   No. Was earlier, but is now rising.

3. Is the number of students wanting to enter the engineering profession generally declining in your country?
   No. Was earlier, but is now rising.

4. Is the level of students entering the schools/ universities in your country declining?
   No. Was earlier, but is now rising.

5. Is the Civil Engineering profession in your country satisfied with the quality and quantity of its members?
   Not totally. In some areas good quality and quantities, in others not. Especially there is a lack of students graduating in the design profession.

6. If the profession is not satisfied, please indicate briefly the main areas of concern (salaries, technical competence, lack of generic skills, lack of specific skills etc).
   The salaries for designers are lower than in other professions. Thus there are difficulties to attract gifted students. Students graduating are of good competence, because the education program is demanding.

7. What are the specific actions being taken by your country to overcome any problems you have identified?
   The low salaries are due to low level of design fees, which in turn is based on the unfortunate fact, that design work is not as highly regarded as it used to be. RIL has a special project to bring to the attention of the clients what good design is and what the benefits of it are. Also marketing work is done among students to enter this career.

8. What are the specific actions being taken by your organisation to enhance the attractiveness of civil engineering profession among young and very young people?
   A group of associations within the civil engineering industry (including RIL) has combined forces to activate a campaign directed at young people (age 10-18) to increase their interest in civil engineering. The main idea is to ensure a uniform strategy and media policy (everybody talks the same way) and carry out projects that explains the content of civil engineering and gives it a better image. Keywords are the national importance of the industry (economical and environmental aspect), the diversity (international and different careers with high opportunities) and a “feeling of positive activity” (spectacular projects, ITC widely applied, human co-operation, etc). The projects are different activities (e.g. at fairs and schools), providing “educational” material for young people with civil engineering content (data programs, books, TV-programs,

competitions, education material for schools, etc.) and different media efforts (websites, magazine for

FRANCE

1. Is the number of students wanting to become civil engineers declining in your country?
   No
2. Is the level of students entering the civil engineering schools/ universities in your country declining?
   No
3. Is the number of students wanting to enter the engineering profession generally declining in your country?
   No
4. Is the level of students entering the schools/ universities in your country declining?
   No

5. Is the Civil Engineering profession in your country satisfied with the quality and quantity of its members?
   Yes

6. If the profession is not satisfied, please indicate briefly the main areas of concern (salaries, technical competence, lack of generic skills, lack of specific skills etc).

7. What are the specific actions being taken by your country to overcome any problems you have identified?
   In order to keep correct the number of students interested in engineering studies, CNISF is doing promotion actions on schools, as well as the National Professional Unions, using various forms (cf The Civil Engineering Profession in)

8. What are the specific actions being taken by your organisation to enhance the attractiveness of civil engineering profession among young and very young people?

   CNISF is active in order to promote the Professions of Engineers.

   - in direction of young students (Classes in “Lycées”), in order to help them to choose orientations allowing them to access to Engineers Careers. The plan “Action 200, Engineer to-morrow” gathers High Schools, Universities and Professionals in order to held forum (contacts with students, parents, teachers), specific presentations, seminars : in year 2002/2003, 210 actions were organised in France.

- Le “salon des ingénieurs” (Engineers Show) is organised every year in order to allow contacts between Firms and Engineers seeking for a first or for a new job. Several thousands of engineers are visiting the Stands during the 2 days of the Show.

- The CNISF Socio-Economical Survey. This survey aims at establishing knowledge on social and economical environment of the Engineer Profession: it deals with Education, Salaries, Career evolution, sectional Activities, Responsibilities involved, Changes in Employment, etc…15th Survey dealing with Year 2002 has been issued in September 2003.

- The yearly “Chéreau-Lavet Award” is opened to Engineers having developed major Innovation already implemented in Production : 2003 Award was attributed to the Engineer having invented the “Self-cleaning glasses” used in the Building Industry.

Professional Federations are also developing very important actions for promotion of the Civil Engineering Profession.

Fédération Nationale des Travaux Publics (FNTP) et Fédération Française du Bâtiment (FFB), as well as other Professional Federations have very important programmes of Promotion. For example, at regional level, FNTP (in partnership with other professionals and local Authorities) shows around 100 actions a year. They involve young students from “Lycées”, Professors, Directors and Inspectors in Education System, unemployed persons, etc… Actions deal with Jobsites Visits, Presentations, professional Exhibitions, etc..

- Main Contractors and professional federations are members of many Councils of Civil Engineering High Schools

Professional Federations offer Grants, as scholarships for Students

GERMANY

1. Is the number of students wanting to become civil engineers declining in your country?
   Yes, the number is much too less and does not fill the gap the retired civils leave. At our university in Oldenburg we have a phantastic increasing slope of freshmen entering our 6 study programmes in the department.

2. Is the level of students entering the civil engineering schools/ universities in your country declining?
   I do not understand this question well. Does it mean the level of secondary education? In the latter case: a clear NO.

3. Is the number of students wanting to enter the engineering profession generally declining in your country?
   Yes, this is generally true for all kind of engineers, except those with additionals like bio-, environmental-, medical- and informatics.

4. Is the level of students entering the schools/ universities in your country declining?
   See question 2.

5. Is the Civil Engineering profession in your country satisfied with the quality and quantity of its members?
   The profession is satisfied concerning the quality, but the quantity varies and especially with big projects it envisages a shortage of civils.

6. If the profession is not satisfied, please indicate briefly the main areas of concern (salaries, technical competence, lack of generic skills, lack of specific skills etc).
   See answer to 5. Even if the salary is better civils do not move too quickly from one to another company or project. It is just the number.

7. What are the specific actions being taken by your country to overcome any problems you have identified?
   1. Germany now attracts a number of foreign civil engineering students who will stay here a while having finished their studies to gain knowledge (for joint ventures e.g.) before going home. 2. At schools the number of lessons in natural sciences is slightly increased. 3. The university try to attract pupils by Kinder-Universitäten in natural or engineering sciences. (I had a lecture in front of 1000 children of age 10 – 13 with the title "Why do house need a coat" and which spoke about all topics of building or environmental physics. I have a vide and/or a PPT-presentation with me at the ECCE-meeting in Zagreb. I will distribute it in Germany and elsewhere …)

8. What are the specific actions being taken by your organisation to enhance the attractiveness of civil engineering profession among young and very young people?
   I have to blame our organisations doing very little and by far not doing enough to attract young people.

GREECE

1. Is the number of students wanting to become civil engineers declining in your country?
   Yes

2. Is the level of students entering the civil engineering schools/ universities in your country declining?
   No

3. Is the number of students wanting to enter the engineering profession generally declining in your country?
   No

4. Is the level of students entering the schools/ universities in your country declining?
   It depends on the type of studies

5. Is the Civil Engineering profession in your country satisfied with the quality and quantity of its members?
   No

6. If the profession is not satisfied, please indicate briefly the main areas of concern (salaries, technical competence, lack of generic skills, lack of specific skills etc).
   Salaries, lack of projects, confusion of laws

7. What are the specific actions being taken by your country to overcome any problems you have identified?
   Last months started an attempt of diminishing the number of laws that rule the public and private works.

8. What are the specific actions being taken by your organisation to enhance the attractiveness of civil engineering profession among young and very young people?
   Members of our organization visit schools and introduce our profession and the achievements of civil engineers through centuries to the students, answering their questions.

LATVIA

1. Is the number of students wanting to become civil engineer declining in your country?
   No. Number of civil engineers is still increasing. The worst times for us were during the middle of nineties.

2. Is the level of students entering the civil engineering schools/ universities in your country declining?
   No. Number of civil engineering students is still slowly increasing. The worst times for us were during the middle of nineties. In comparison with that time number of entering students is increased approximately three times.

3. Is the number of students wanting to enter the engineering profession generally declining in your country?

No. There was a tendency to decreasing of engineering students during the middle of nineties when high level civil servants told, that Latvia does not need engineers but only economists and lawyers.

4. Is the level of students entering the schools/ universities in your country declining?
   Not at all. There is founded lot of new private higher educational establishments and in state owned universities number of entering students also is one of the biggest.

5. Is the Civil Engineering profession in your country satisfied with the quality and quantity of its members?
   There is Civil Engineer's Association in Latvia, what has found out that there exists an essential need of civil engineers. So, concerning quantity, we still have less specialists than necessary. Speaking about quality situation is much better and in general, construction companies are satisfied with quality of new engineers.

6. If the profession is not satisfied, please indicate briefly the main areas of concern (salaries, technical competence, lack of generic skills, lack of specific skills etc).
   NA (see above)

7. What are the specific actions being taken by your country to overcome any problems you have identified?
   Our study programs in Riga Technical University are internationally accredited. One of preconditions before starting this process was professional standard. This document defines all necessary skills and knowledge of new specialist. Professional standard was created by company representatives and not by teaching staff. Afterwards it was adopted by Ministry of education. Of course, there were lot of consultations between companies, and us so that professional standard might be considered as a specific action.

8. What are the specific actions being taken by your organisation to enhance the attractiveness of civil engineering profession among young and very young people?
   There are special exhibitions "School" what annually are held in March. During these events lot of information is spread out. There is also such an annually event as "Open doors", when pupils are invited to our university to be acquainted with existing study system and other requirements of our study programs. To be honest **just now** we do not need to enhance attractiveness of civil engineering. Who knows how it will be after some years.

LITHUANIA

1. Is the number of students wanting to become civil engineer declining in your country?
   Not declining in general. However, it is changing /increasing number of specializations of civil engineering. Relatively,declining number of wishing to study structural engineering.

2. Is the level of students entering the civil engineering schools/ universities in your country declining?
   Such tendency was not recognized.

3. Is the number of students wanting to enter the engineering profession generally declining in your country?
   Total number is not declining. However, ratio of wishing to study engineering with those wishing to study management, law, business declining, because the latest professions expanded significantly.

4. Is the level of students entering the schools/ universities in your country declining?
   Such tendency was not recognized.

5. Is the Civil Engineering profession in your country satisfied with the quality and quantity of its members?
   Profession needs more practically orientated graduates.

6. If the profession is not satisfied, please indicate briefly the main areas of concern (salaries, technical competence, lack of generic skills, lack of specific skills etc).
   Again, concern of practical orientation. Salaries are small in comparison with layers or businessman.

7. What are the specific actions being taken by your country to overcome any problems you have identified?
   Universities are signing agreements with civil engineering companies and associations for practical placement during the summer vacation of students.

8. What are the specific actions being taken by your organization to enhance the attractiveness of civil engineering profession among young and very young people?
   Actions:
   a. Universities are arranging open door days;
   b. “Builders day” is celebrated in August every year;
   c. University lecturers are visiting secondary schools for promoting Civil Engineering/Engineering profession.

POLAND

1. Is the number of students wanting to become civil engineers declining in your country?
   No

2. Is the level of students entering the civil engineering schools/ universities in your country declining?
   No

3. Is the number of students wanting to enter the engineering profession generally declining in your country?
   No

4. Is the level of students entering the schools/ universities in your country declining?
   No

5. Is the Civil Engineering profession in your country satisfied with the quality and quantity of its members?
   Yes, as on the level of development of Polish free market economy since 1989 year.

6. If the profession is not satisfied, please indicate briefly the main areas of concern (salaries, technical competence, lack of generic skills, lack of specific skills etc).
   Systematic progress is observed in all of the areas, but unfortunately increasing of salaries is weak.

7. What are the specific actions being taken by your country to overcome any problems you have identified?
   Polish Chamber of Civil Engineers identifies all types of problems in the civil engineering area, informs on these problems by publications and undertakes legislative co-operation if it is necessary to improve of situation. For example, the most important actions in the last time have been concerned to the changes in Polish Building Law and Public Procurement Law.

8. What are the specific actions being taken by your organisation to enhance the attractiveness of civil engineering profession among young and very young people?
   Participation in attractive practices inside the country and abroad, technical visits end excursions, individual course of study, membership of students in scientific-technological Circles of Interests, membership of students after 3-year study in scientific-technological associations, attendance in professional practice under supervising of academic teacher being also civil engineer specialist, commitment in scientific-technological and publishing activity during seminars and scientific-technological conferences, assistance in the professional experience and practice to the purpose of achievement of the professional authorization.

PORTUGAL

1. Is the number of students wanting to become civil engineers declining in your country?
   Slightly

2. Is the level of students entering the civil engineering schools/ universities in your country declining?
   No

3. Is the number of students wanting to enter the engineering profession generally declining in your country?
   Very few want to enter the profession

4. Is the level of students entering the schools/ universities in your country declining?
   Yes

5. Is the Civil Engineering profession in your country satisfied with the quality and quantity of its members?
   Quality - yes, quantity - need more

6. If the profession is not satisfied, please indicate briefly the main areas of concern (salaries, technical competence, lack of generic skills, lack of specific skills etc).
   Technical competence from low level universities

7. What are the specific actions being taken by your country to overcome any problems you have identified?
   We are importing engineers

8. What are the specific actions being taken by your organization to enhance the attractiveness of civil engineering profession among young and very young people?
   Presently none! But the ideas are:
   - to make promotional videos/ TV programs related to important structures and famous engineers
   - to act in secondary schools with live presentations explaining what is a "civil engineer"

ROMANIA

This material was provided by Prof. Florin-Ermil DABIJA, Member of the Council of the Association of Structural Design Engineers (AICPS) and Prof. Iacint MANOLIU, President of the Romanian Geotechnical Society, on behalf of the Union of Associations of Civil Engineers of Romania

1. Is the number of students wanting to become civil engineers declining in your country?

Due perhaps to a persistent lack of adequate information, young people potentially interested in civil engineering - as well as the public at large - currently have a somewhat confuse perception about this profession. Civil engineering appears to many people as a technical domain with a rather slow development, lagging far behind other sectors of activity, enjoying little consideration by mass-media and being seldom rewarding. Although civil engineers carry burden of responsibility and risk in the construction field, their professional and social-economical merits are far from being correctly understood and recognized by the society.

As a direct consequence, a slight decline in the number of applicants for university education in the field of civil engineering has become apparent in the last few years.

However, the demand for various sectors within the field is not uniform.

Thus, the number of applicants is significantly higher in case of structural and service/utility engineering faculties or departments than in case of those dealing with transportation infrastructure, hydraulic engineering or sanitary engineering.

2. Is the level of students entering the civil engineering schools/ universities in your country declining?

The average level of students starting their studies in civil engineering in Romanian universities, as reflected by the fundamental knowledge in mathematics and physical sciences acquired during the secondary school education, can be considered relatively modest, so that some of them encounter later serious difficulties. In general, only about two thirds of the students enrolled in the first year complete their studies and get the corresponding academic degree.

3 Is the number of students wanting to enter the engineering profession generally declining in your country?

Definitely yes. But civil engineering is in a better position than other fields, like chemical engineering, mechanical engineering, aerospace engineering.

4. Is the level of students entering the schools/ universities in your country declining?

As a whole, there is a decline, due also to demographic reasons.

5. Is the civil engineering profession in your country satisfied with the quality and quantity of its members?

From the quantitative point of view, the present situation in the field of civil engineering in Romania could be generally termed as satisfactory. But if, as expected and intended, the activity in this sector will be significantly expanded through large domestic and, especially, foreign investments, a scarcity of young civil engineers actively involved in the construction industry is likely to occur.

It is quite unfortunate that, nowadays, many young civil engineers leave the profession after a few years of activity in favour of more attractive and more rewarding opportunities in other domains, where far better salaries and perhaps higher social-professional status can be obtained.

As far as the qualitative aspect is concerned, there are somewhat mixed opinions. Alongside young civil engineers with a high level of professional knowledge, eager to broaden their horizon and to take an active part in solving new problems and to innovate, there are much more those who prefer to get involved in merely routine activities, sometimes including considerable administrative tasks instead of technical ones. At present there are many "average" civil engineers. To raise the average level this will require conjugated efforts of the academic and professional worlds, but also cultural and educational changes. The process would probably take a generation to be fully implemented.

6. If the profession is not satisfied, please indicate briefly the main areas of concern (salaries, technical competence, lack of generic skills, lack of specific skills etc).

Inadequate salary level appears to be one major concern. There are significant discrepancies between different sectors and constructions are in an uncomfortable position. The fee levels, which are determinant for the level of salaries, are particularly low in case of civil engineering services and, on long term, may have considerably detrimental effects upon the profession.

Other areas of concern in connection with the activity of young civil engineers are often related to inadequate competences (technical, communication and managerial skills), lack of problem-solving ability, insufficient interest in continuous professional development etc. It is also worth mentioning the excessive tendency to rely entirely on the results provided by computer, without the ability to use simple checking procedures.

Areas where specific skills appear to be in short supply include: site-works and quantity surveyors, quality control inspectors, resource management and marketing specialists, as well as technicians.

7. What are the specific actions being taken by your country to overcome any problems you have identified?

If significant enhancement of the attractiveness of the civil engineering profession is to be obtained more rapidly, concerted and continuous actions should be carried out by all parties concerned-universities, industry and professional organizations in the first place. Generating a correct perception of civil engineering profession requires a broad public awareness of its characteristics and specific problems.

Such actions are currently under way, but there is strong need to develop them both qualitatively and quantitatively. Among the various examples in this respect one could mention: improvement of the information flow on civil engineering matters and achievements; increased cooperation between the academic milieu, construction industry units and professional organizations (joint organization of technical-scientific conferences, seminars and symposia, exchange of information and expertise, specialized lectures and round tables, post-graduate training of employees, scholarships and practical stages aimed at updating and upgrading the level of existing professional knowledge etc).

Structural changes in the university programmes - including, of course, civil engineering domain - will be implemented starting the academic year 2005 - 2006, and certainly deserves a distinct discussion. A few examples of potential new developments within the educational process are mentioned in this respect: broadening and overlapping to a certain extent the education of certain disciplines, to prepare students for the beginning of life-long learning; emphasizing the importance of multidisciplinary teaching and leaving freedom for students to choose options; tailoring the process to prepare students for continuous change, with a better understanding of the social-economical framework of construction and the built environment, more effective communication and increased awareness of the impact on the planet; expanding, updating and upgrading the use of IT-based methods of training in civil engineering; improving the balance between technical and managerial education, as well as that between theoretical and practical components of any complex training.

8. What are the specific actions being taken by your organisation to enhance the attractiveness of civil engineering profession among young and very young people?

There is quite a direct and permanent channel of information flow and exchange of expertise between the professional associations members of the Union of Associations of Civil Engineers of Romania, such as the Association of Structural Design Engineers (AICPS), Romanian Geotechnical Society, Romanian Tunneling Society, and the technical universities having faculties of departments of civil engineering, due to the presence of many professors in the staff of the respective professional organizations.

Among the specific actions contributing to enhance the attractiveness of civil engineering profession one should mention: joint organization of technical-scientific conferences and symposia, specialized lectures or courses delivered by associate professors selected from outstanding specialists in structural design, technical guidance in the preparation of certain graduation projects, publication of papers prepared by young civil engineers, presentation of papers by young civil engineers during special sessions at the conferences of the professional associations.

SLOVAK REPUBLIC

1. Is the number of students wanting to become civil engineers declining in your country?
   The number of students who are interested to become civil engineers is slightly declining. - Yes

2. Is the level of students entering the civil engineering schools/ universities in your country declining?
   The level of students entering the civil engineering schools/universities in Slovakia is stable and partially increasing, especially in the field of students' knowledge of foreign languages through the influence of new milieu of European Union - No

3. Is the number of students wanting to enter the engineering profession generally declining in your country?

The number of students wanting to enter the engineering profession in Slovakia is currently, after some years of crises, increasing - No

4. Is the level of students entering the schools/ universities in your country declining?
   No

5. Is the Civil Engineering profession in your country satisfied with the quality and quantity of its members?
   In general - Yes

6. If the profession is not satisfied, please indicate briefly the main areas of concern (salaries, technical competence, lack of generic skills, lack of specific skills etc).
   We are not satisfied with the general recognition – the status of the civil engineer in the Slovak society since it is not at the same level as the status of lawyers, medical doctors, architects and so on. Moreover, we are not satisfied with the lower level of salaries of civil engineers in Slovakia.

7. What are the specific actions being taken by your country to overcome any problems you have identified?
   To overcome these problems, seminars, conferences and other events are organised to promote the civil engineering profession. The chamber also contacts media and lobbies for the civil engineers in the Slovak as well as the European Parliament. Very important tool to overcome theses problems is the lifelong education of our members.

8. What are the specific actions being taken by your organisation to enhance the attractiveness of civil engineering profession among young and very young people?
   To enhance the attractiveness of the civil engineering profession among young people the engineering universities try to promote our profession at secondary schools and technical institutes and so on.

SPAIN

1. Is the number of students wanting to become civil engineer declining in your country?
   No, it is stable to slightly increasing

2. Is the level of students entering the civil engineering schools/ universities in your country declining?
   Yes

3. Is the number of students wanting to enter the engineering profession generally declining in your country?
   We see a slight increase, as the companies require more specialists

4. Is the level of students entering the schools/ universities in your country declining?
   Yes

5. Is the Civil Engineering profession in your country satisfied with the quality and quantity of its members?
   No

6. If the profession is not satisfied, please indicate briefly the main areas of concern (salaries, technical competence, lack of generic skills, lack of specific skills etc). By importance: lack of technical competence, salaries, a high number of graduates, lack of specific skills.

7. What are the specific actions being taken by your country to overcome any problems you have identified?
   We cannot not tell at this stage

8. What are the specific actions being taken by your organisation to enhance the attractiveness of civil engineering profession among young and very young people?
   By organizing conferences with a certain frequency in different parts of the country

TURKEY

1. Is the number of students wanting to become civil engineer declining in your country?
   No

2. Is the level of students entering the civil engineering schools/ universities in your country declining?
   Yes, with respect to the same point of view presented in question number 4

3. Is the number of students wanting to enter the engineering profession generally declining in your country?
   No

4. Is the level of students entering the schools/ universities in your country declining?
   Yes, relative to the overall level loss based on the incompetence of OSS, general university entrance exam. As mentioned in previous education report of Turkey, all students willing to enter a university must take the entrance exam, OSS. Unfortunately, the concept and evaluation of OSS is not satisfactory for university education in Turkey, especially for engineering education. Therefore, student selection and evaluation for engineering departments are not being executed as necessary.

5. Is the Civil Engineering profession in your country satisfied with the quality and quantity of its members?
   Civil engineering profession in Turkey can be expressed as satisfactory quantitatively, as there are around 75000 civil engineers in Turkey, of around 70 million population. Although this civil engineer percentage, the qualitative aspect of Turkish civil engineering profession is unfortunately questionable, which is not satisfactory with respect to current civil engineering view in Turkey.

6. If the profession is not satisfied, please indicate briefly the main areas of concern (salaries, technical competence, lack of generic skills, lack of specific skills etc).
   Considering the unequal education context of Turkish universities and civil engineering departments, graduate engineers form a wide range of engineer typology and profile. As there are examplary successfull civil engineers in Turkish sector, there are also concerning low profiles in the profession. This leads to an unbalanced satisfaction, or unsatisfaction within profession, where the main concerns include salary, technical competence, lack of generic and specific skills, background education, etc.

7. What are the specific actions being taken by your country to overcome any problems you have identified?
   There are no rigid actions being taken by government authorities or departments to overcome the general quality concerns mentioned above. There are some legal studies and preparations within Ministry of Prosperity in order to execute better construction control system and professional criteria. There are also civil efforts for university accreditations by organisations such as MÜDEK (formerly mentioned in education report).
   As Turkish Chamber of Civil Engineers, we have been organising profession related seminars, panel discussions, courses on specified subjects and technical workshops for our member engineers. TCCE has also been executing legal draft studies for construction quality control, and chartered engineering which is an essential issue in Turkey. Within the task force commissions of TCCE, Chartered Engineering Commission has been preparing the legislative drafts since August 2004, and has recently completed the chamber statutes. The chartered engineering practice will take start in 2005 by TCCE.

8. What are the specific actions being taken by your organisation to enhance the attractiveness of civil engineering profession among young and very young people?
   Young colleagues' and students' relation with the profession have always been given importance by TCCE. Therefore, some of our branches have been executing student memberships for the chamber, and providing platforms for young colleagues to discuss their point of view for

profession. One of the upcoming events of TCCE, is the Student Congress in October 2004, which will be held in Ankara and will form an initiative national platform of Turkish civil engineering students.
There are also seminars, panels, congresses, conferences, as well as chamber publications including attractive attitudes towards young people, based on the necessity to mention qualitative engineering priority

UNITED KINGDOM

This response was prepared by Institution of Civil Engineers, UK.

1. Is the number of students wanting to become civil engineer declining in your country?

It was declining since the end of the 1990s, but the last year there has been a slight increase.

2. Is the level of students entering the civil engineering schools/ universities in your country declining?

Same as above.

3. Is the number of students wanting to enter the engineering profession generally declining in your country?

Same as number one.

4. Is the level of students entering the schools/ universities in your country declining?

5. Is the Civil Engineering profession in your country satisfied with the quality and quantity of its members?

Quality: Yes. Quantity: No. A minority of all graduated civil engineers end up as chartered members of the Institution of Civil Engineers. Many civil engineers go into other careers – and there is a risk of a skills shortage in the future.

6. If the profession is not satisfied, please indicate briefly the main areas of concern (salaries, technical competence, lack of generic skills, lack of specific skills etc).

As indicated above, far from all civil engineers go through the process of being professionally qualified with ICE, either because they don’t see the relevance or benefits of being a chartered engineer and belonging to a professional body. The other problem is that many civil engineers leave the profession to seek employment in other areas, e.g. financial services, were salaries are higher.

7. What are the specific actions being taken by your country to overcome any problems you have identified?

With regard to membership: make potential members aware of the benefits of belonging to a professional organization and increasing the relevance of ICE to its members.

8. What are the specific actions being taken by your organisation to enhance the attractiveness of civil engineering profession among young and very young people?

ICE is investing heavily in marketing and informing young children at school about civil engineering and what a civil engineer does.

APPENDIX B

SCHOOLS QUESTIONNAIRE AND DATA

EUCEET universities have contacts with many schools which supply the students who come to study for degree courses, and we took the opportunity offered by these contacts to seek the views of school pupils preparing for university and deciding which course to take. Some universities have developed contacts with schools which are particularly well disposed to engineering, either because of early selection or because of a tradition of encouraging scientific and mathematical studies. Thus, it is likely that there will be a bias towards scientific and engineering disciplines in some cases.

School pupils were asked about factors which influence their choice of university study, perceptions of Civil Engineering courses and views of the Civil Engineering profession. Results were presented in three tables. The first dealt with factors influencing school pupils as they make their choice of university course. Eight factors were proposed and students were invited to select as many as they wish. All choices were counted and the number of times each factor was cited was tabulated as a percentage. The second table showed school pupils' views of civil engineering courses. Six suggestions were offered and students were again invited to select as many as they wished. The importance of each was recorded as a percentage. The third table concerned school pupils' vies of the Civil Engineering Profession. Seven factors were offered, students made their selections and the importance of each was recorded as a percentage.

In a number of cases, data was analysed graphically. In these cases, five graphs were produced. The first showed the split of choices between a number of university courses and the second showed degree of certainty of the choice of engineering. The third, fourth and fifth images were graphical representation of tables 1, 2 and 3 respectively, allowing us to see the difference in perceptions, if any between engineering orientated and non-engineering orientated students.

The questionnaire is set out below, followed by the data for each country.

****

EUROPEAN CIVIL ENGINEERING EDUCATION AND TRAINING

SP9: ENHANCING THE ATTRACTIVENESS OF THE CIVIL ENGINEERING PROFESSION

Questionnaire to <u>School Pupils</u>

<u>Background</u>

Students applying to study Civil Engineering at University are becoming less abundant across much of the EU. Some of this may be due to demographics, some to lower social status and earning opportunities of engineering graduates compared to other professions, and some of it may be due to other factors related to 'fashion' and increasing competition for mathematically able students. In some countries the popularity of Civil Engineering courses may be increasing.

SP9 is considering this issue as part of an EU investigation into why people study various subjects (or choose not to study certain subjects). We are therefore conducting a survey to gain some indication of what interests school pupils about the possibility of studying for a degree in Civil Engineering, and get some idea of what school pupils think about Civil Engineering, even if they do not intend to study it. We are VERY interested in your opinions, so please spend a few minutes filing in the following Questionnaire. We are seeking your help, as young people planning your careers and studying many different topics, to understand these questions. Your help is much appreciated.

EUCEET SP9 Committee

QUESTIONNAIRE FOR SCHOOL PUPILS PREPARING TO GO TO UNIVERSITY

Please mark the appropriate answer(s) with an 'x' in the attached box.

1. In which country are you studying?

____

2. Which type of University study would you like to undertake?

	Law		Economics
	Human Science		Medicine
	Engineering		Other

3. Is your choice?

	Definite		Not Sure

4. If your choice is not sure, which is the degree of uncertainty?

	High		Medium		Low

5. Which factors have influenced your choice of University Study? Please cross as many boxes as you wish.

	Attractiveness of the Profession		Easiness of studies
	Cultural Interests		Short duration of studies
	Prestige of the profession		Suggestion by parents/friends
	Possibility of high incomes		Other

6. Whether or not you intend to study Civil Engineering, please tell us what you think about Civil Engineering courses? Cross as many boxes as you wish.

	Tedious subjects		Interesting Subjects
	Useful for practical Applications		Easy Subjects
	Difficult Studies		Don‘t know much about Civil Engineering

7. Whether or not you are thinking of applying for a course in Civil Engineering, please tell us what you think about the Civil Engineering Profession. Cross as many boxes as you wish.

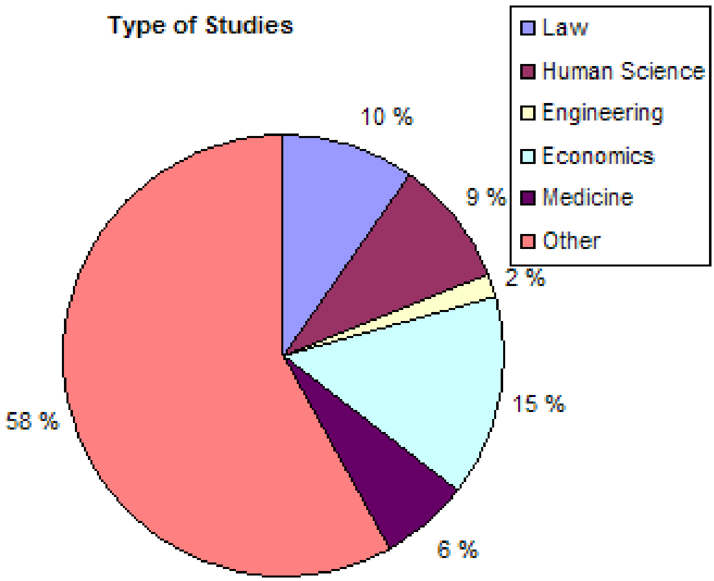
	Responsible for environmental damage
	Difficult job not well paid
	Gives the impression that everything can be calculated and explained
	Useful to remediate environmental disaster
	Prestigious job well paid
	Capable of solving practical problems
	Don’t know much about the Civil Engineering Profession
	Anything else (Please specify)

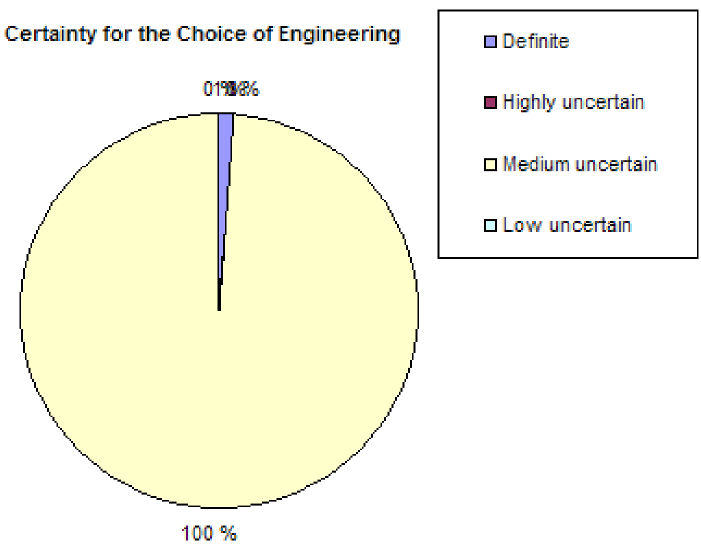
The results of the questionnaire are set out below, country by country.

CYPRUS

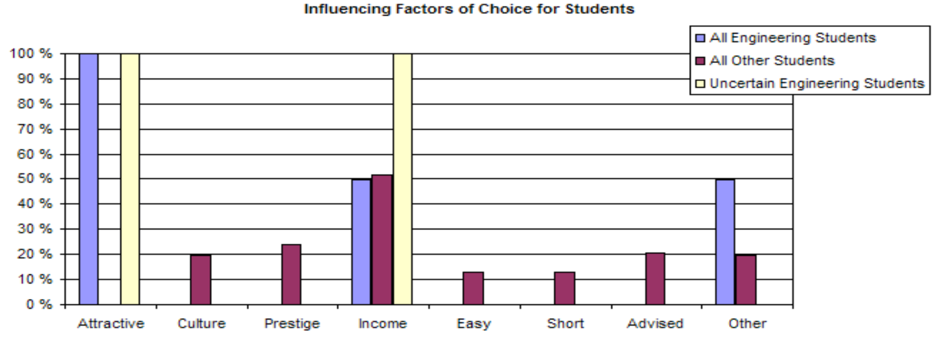
Data from schools in Cyprus is presented below as a series of 5 Graphics:

Type of Studies that students are interested in:

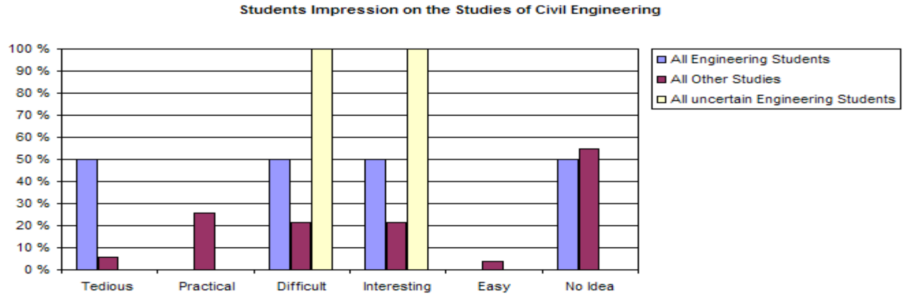




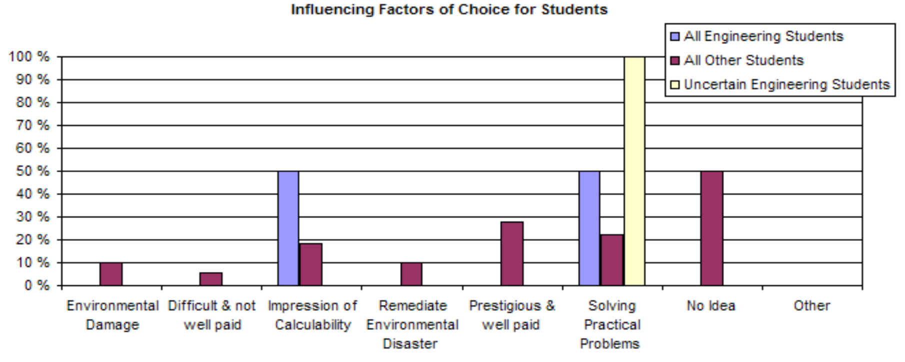
What factors have influenced your choice of university studies?



What do you think about university courses?



What factors influence your perceptions of the Civil Engineering Profession?



CZECH REPUBLIC

Colleagues at the University of Pardubice sent questionnaires to a selection of schools. 42 replies were received showing a broad range of subject choices, 17 of which were described as definite.

The three tables are set out below.

Factors influencing students' choice of university study	Percent Importance
Attractiveness of the Profession	16
Cultural interest	14
Prestige of the Profession	17
Possibility of high salaries	20
Ease of studies	4
Short duration of studies	0
Suggestions from parents/friends	16
Other factors	14

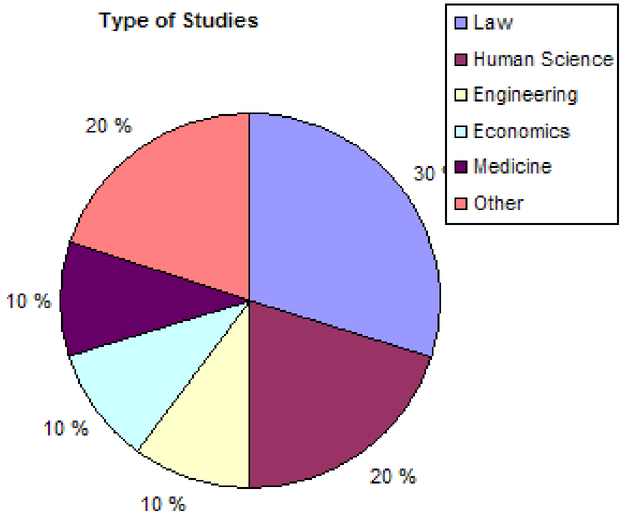
School pupils' views of civil engineering courses	Percent Importance
Tedious subject	6
Useful for practical applications	28
Difficulty subject	36
Interesting subject	16
Easy subject	0
Don't know much about civil engineering	14

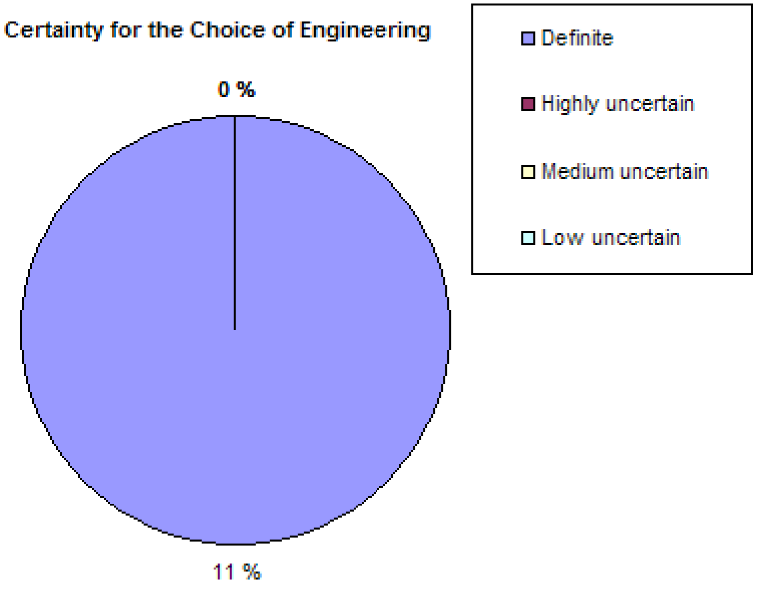
School pupils' views of the civil engineering profession	Percent Importance
Responsible for environmental damage	9
Difficult job, not well paid	6
Gives the impression that everything can be calculated and explained	15
Useful for remediating environmental damage	7
Prestigious and well paid Profession	17
Useful for solving practical problems	33
Don't know much about civil engineering	13

Data for schools provided by Pardubice was also analaysed in two separate groups, Gymnasium schools and Professional school. The graphs are set out below:

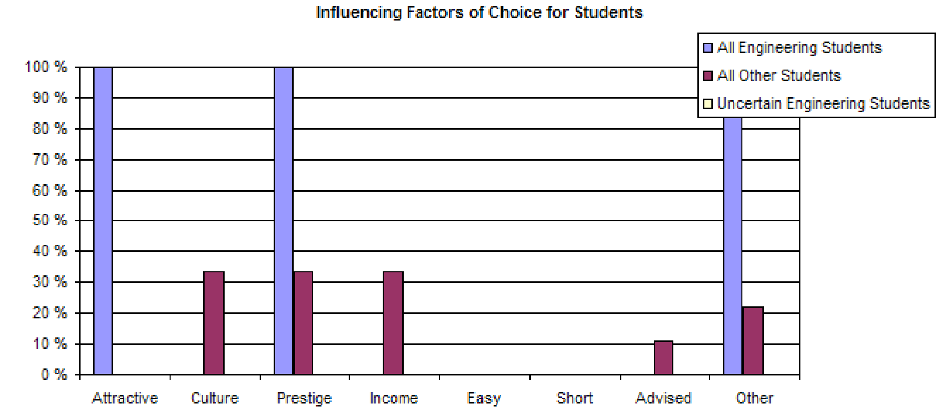
Gymnasium Schools:

What type of university studies are you interested in?

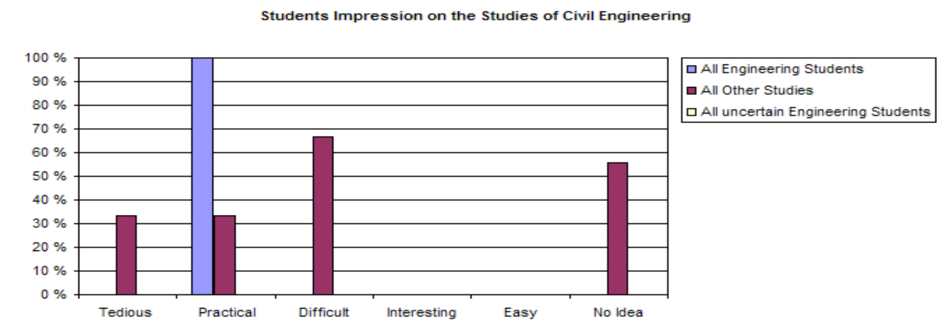




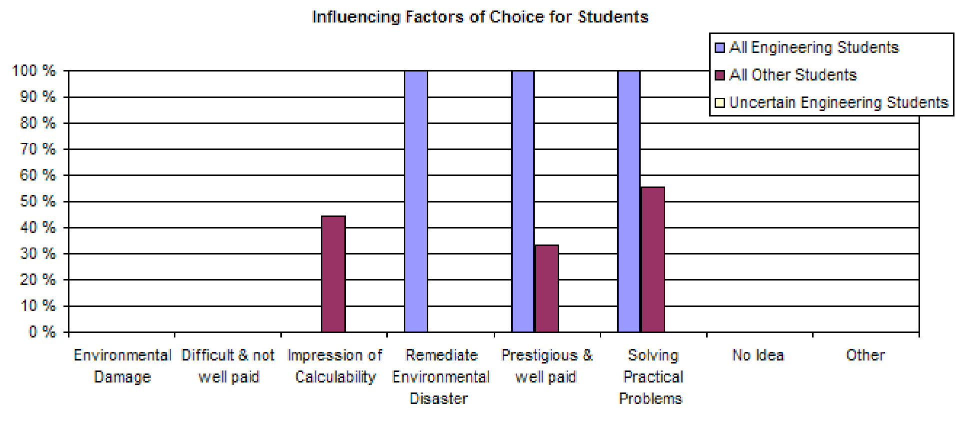
What factors have influenced your choice of university studies?



What factors have influenced your impressions of university courses in Civil Engineering?

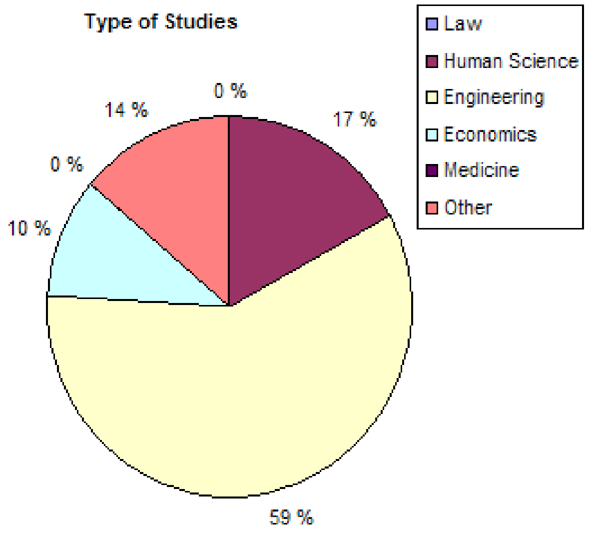


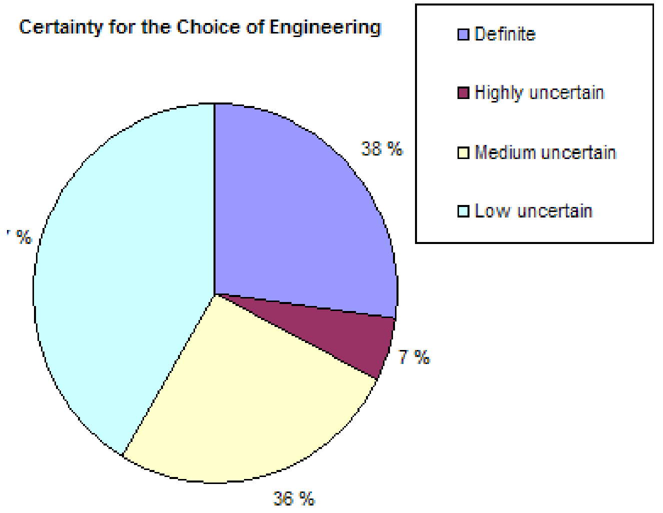
What factors have influenced your perceptions of the Civil Engineering Profession?



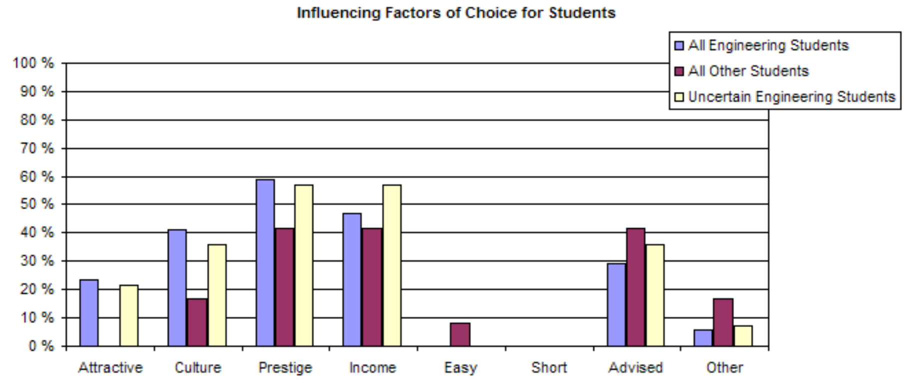
Professional Schools:

What type of studies are you interested in?

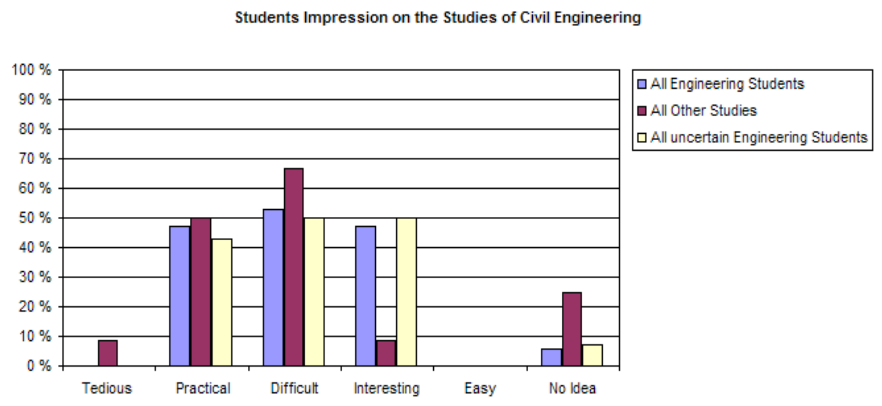




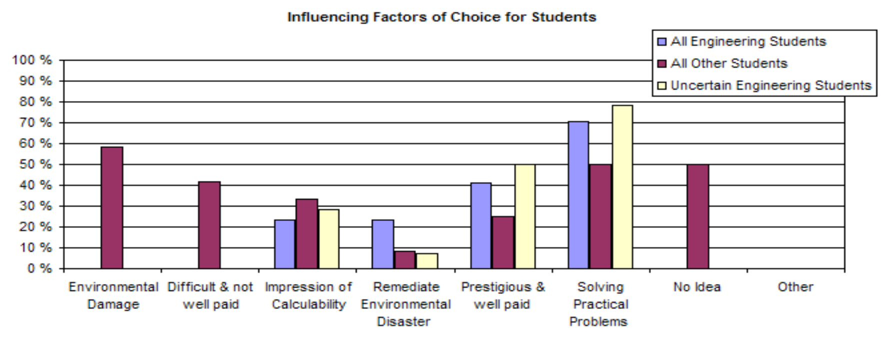
What factors have influenced your choice of university study?



What factors have influenced your perceptions of Civil Engineering courses?



What factors have influenced your views of the Civil Engineering Profession?



ESTONIA

Colleagues at the TU Tallinn conducted survey. 201 responses were received, from three different schools and data was treated as a single group. 34% of pupils said they were interested in studying engineering, and 45% of the sample said that their choice of university study was definite. Data is tabulated below.

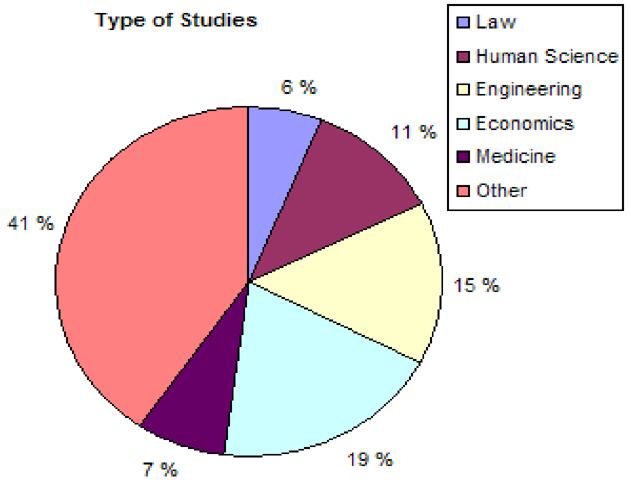
Factors influencing students' choice of university study	Percent Importance
Attractiveness of the Profession	27
Cultural interest	8
Prestige of the Profession	14
Possibility of high salaries	21
Ease of studies	4
Short duration of studies	2
Suggestions from parents/friends	13
Other factors	9

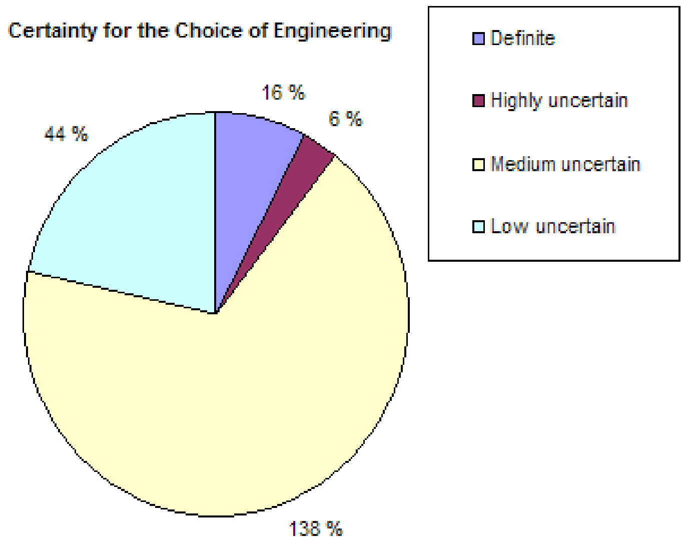
School pupils' views of civil engineering courses	Percent Importance
Tedious subject	5
Useful for practical applications	18
Difficulty subject	13
Interesting subject	21
Easy subject	2
Don't know much about civil engineering	43

School pupils' views of the civil engineering profession	Percent Importance
Responsible for environmental damage	12
Difficult job, not well paid	6
Gives the impression that everything can be calculated and explained	12
Useful for remediating environmental damage	5
Prestigious and well paid Profession	10
Useful for solving practical problems	19
Don't know much about civil engineering	37

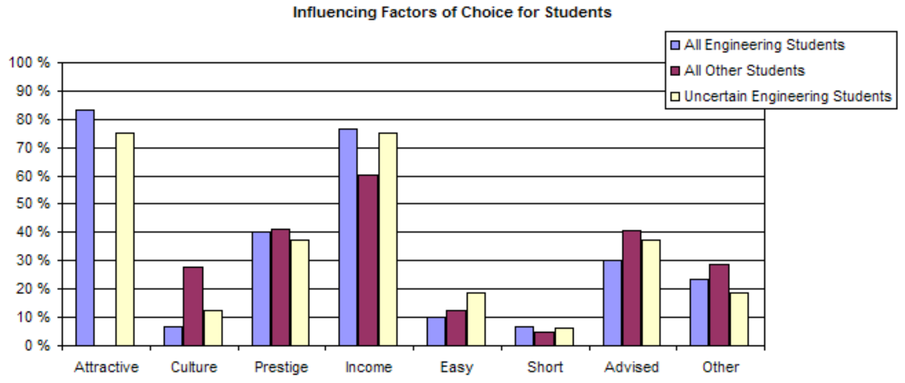
The schools data for Tallin was also presented as a series of graphics, which are set out below:

What type of studies are you interested in?

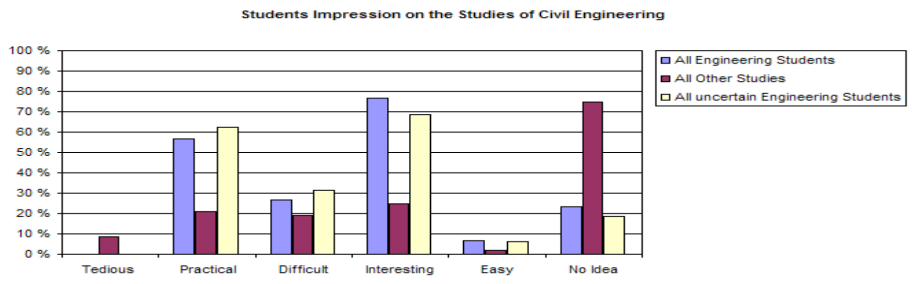




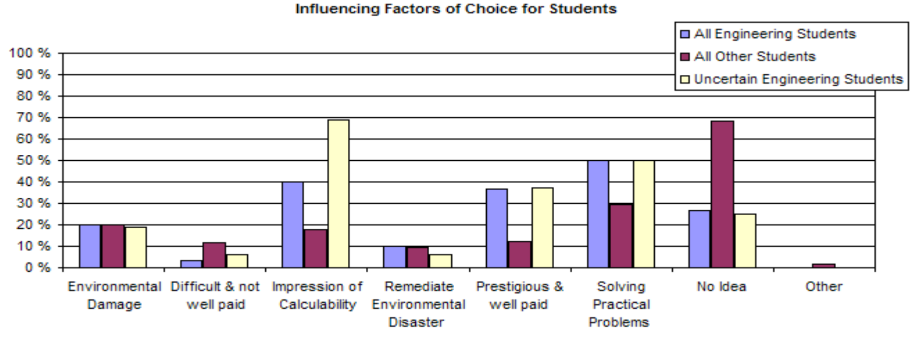
What factors have influenced your choice of university studies?



What factors have influenced your impressions of Civil Engineering courses?



What factors have influenced your views of the Civil Engineering Profession?



HOLLAND

Colleagues at TU Delft conducted the survey. Of the schools surveyed, 40% of respondents were keen on engineering and 67% of all respondents said that they were definite about their choice of university course. Data is tabulated below.

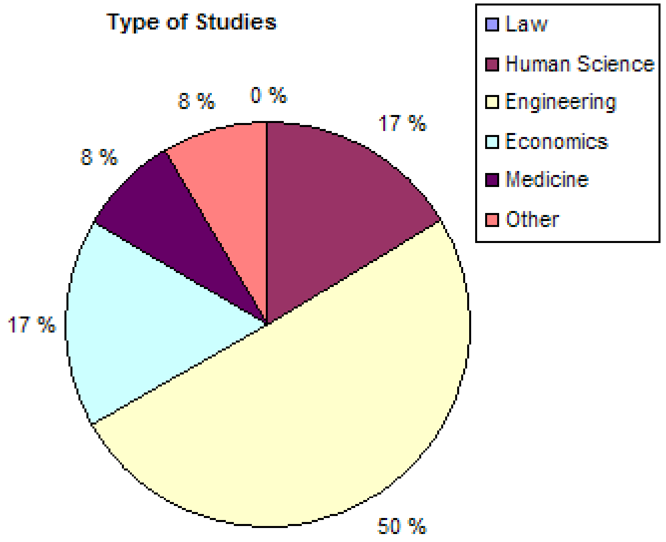
Factors influencing students' choice of university study	%age of Students selecting each Factor
Attractiveness of the Profession	67
Cultural interest	7
Prestige of the Profession	20
Possibility of high salaries	27
Ease of studies	0
Short duration of studies	0
Suggestions from parents/friends	27
Other factors	

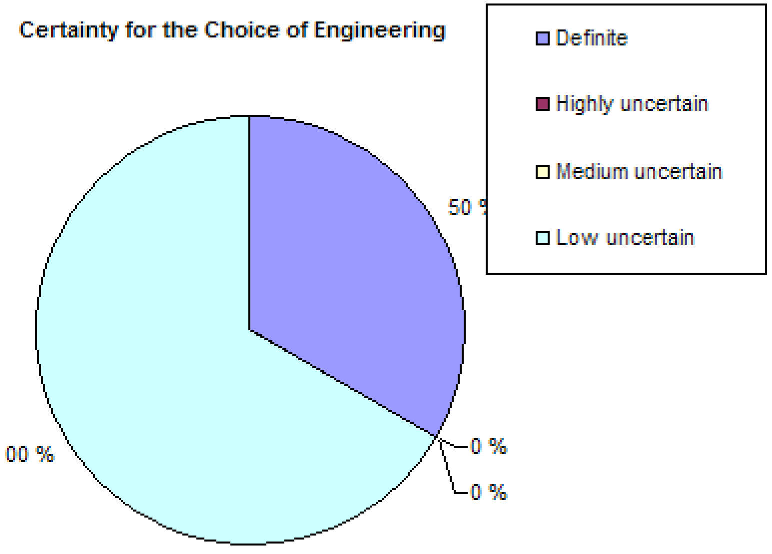
School pupils' views of civil engineering courses	%age of Students selecting each Factor
Tedious subject	7
Useful for practical applications	20
Difficulty subject	20
Interesting subject	40
Easy subject	0
Don't know much about civil engineering	27

School pupils' views of the civil engineering profession	%age of Students selecting each Factor
Responsible for environmental damage	7
Difficult job, not well paid	13
Gives the impression that everything can be calculated and explained	7
Useful for remediating environmental damage	0
Prestigious and well paid Profession	7
Useful for solving practical problems	47
Don't know much about civil engineering	40

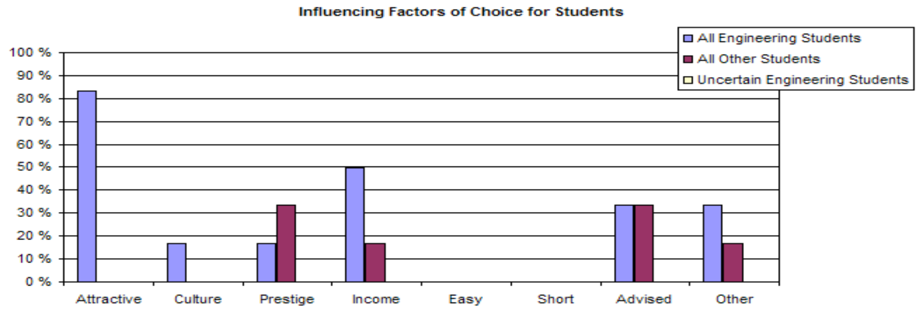
Data from Dutch schools is also represented graphically, in 5 charts, set out below:

What type of studies are you interested in?

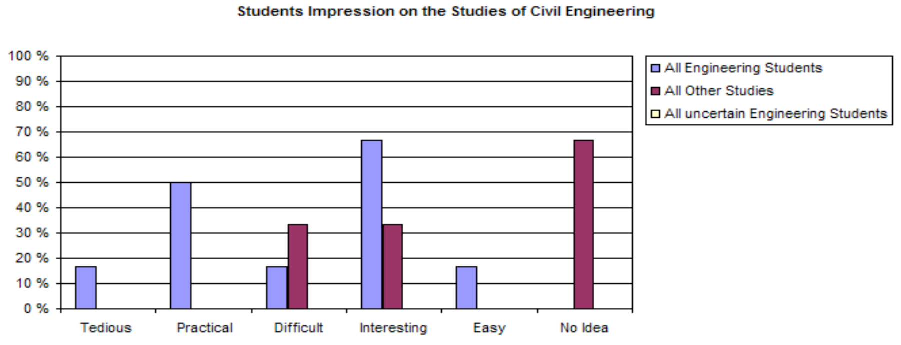




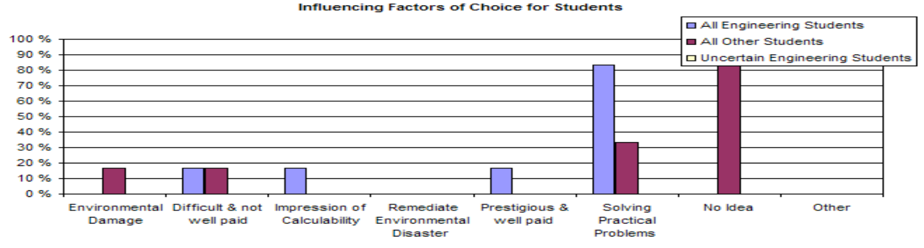
What factors have influenced your choice of university study?



What factors have influenced your impressions of Civil Engineering courses?



What factors have influenced your views of the Civil Engineering Profession?



HUNGARY

A sample of 755 school pupils was surveyed by colleagues at the Budapest University of Technology and Economics, and data is tabled below.

Factors influencing students' choice of university study	Percent Importance
Attractiveness of the Profession	30
Cultural interest	10
Prestige of the Profession	13
Possibility of high salaries	20
Ease of studies	3
Short duration of studies	2
Suggestions from parents/friends	11
Other factors	11

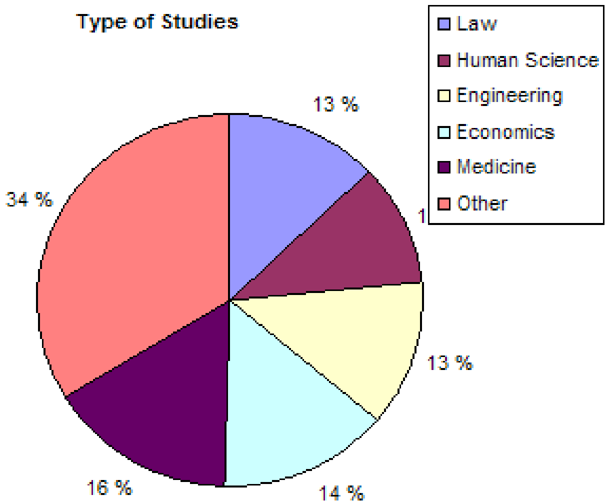
School pupils' views of civil engineering courses	Percent Importance
Tedious subject	9
Useful for practical applications	24
Difficulty subject	21
Interesting subject	18
Easy subject	1
Don't know much about civil engineering	28

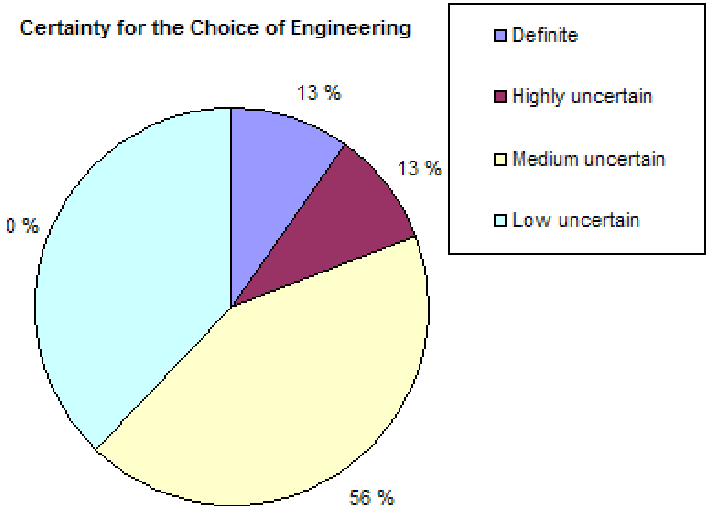
School pupils' views of the civil engineering profession	Percent Importance
Responsible for environmental damage	6
Difficult job, not well paid	6
Gives the impression that everything can be calculated and explained	11
Useful for remediating environmental damage	14
Prestigious and well paid Profession	18
Useful for solving practical problems	26
Don't know much about civil engineering	19

IRELAND

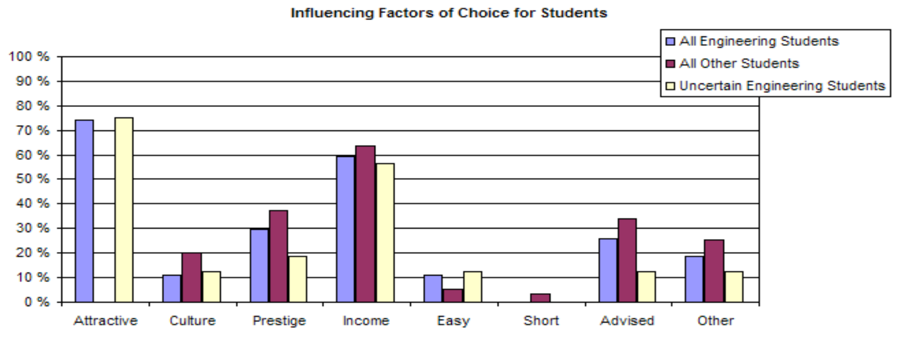
Data from Irish schools was collected by colleagues at University College Dublin, and is set out below.

What type of university studies are you interested in?

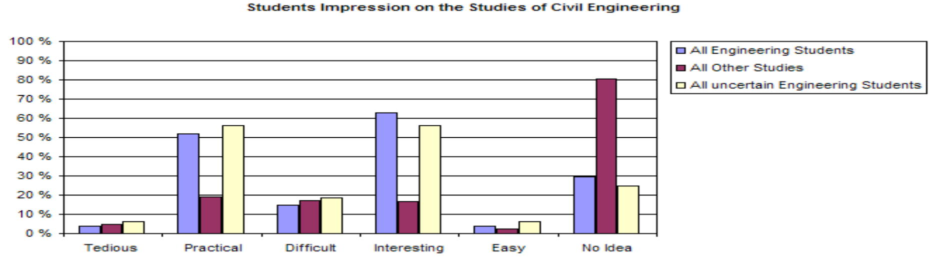




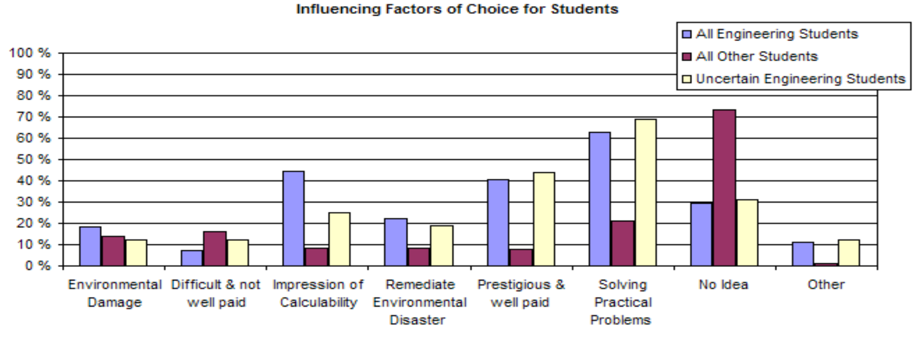
What factors have influenced your choice of university studies?



What factors have influenced your views of Civil Engineering courses?



What factors have influenced your views of the Civil Engineering Profession?



ITALY - Firenze

Data from a sample of 38 school pupils was collected by colleagues at the University of Firenze, , and is tabulated below.

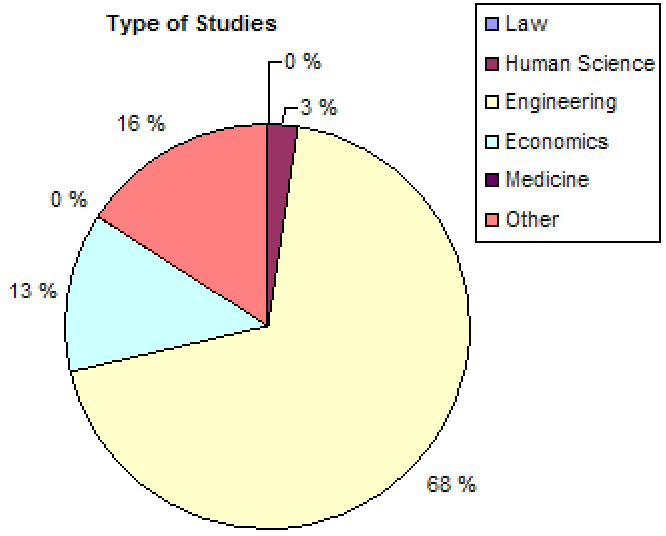
Factors influencing students' choice of university study	Percent Importance
Attractiveness of the Profession	31
Cultural interest	13
Prestige of the Profession	23
Possibility of high salaries	14
Ease of studies	0
Short duration of studies	0
Suggestions from parents/friends	18
Other factors	2

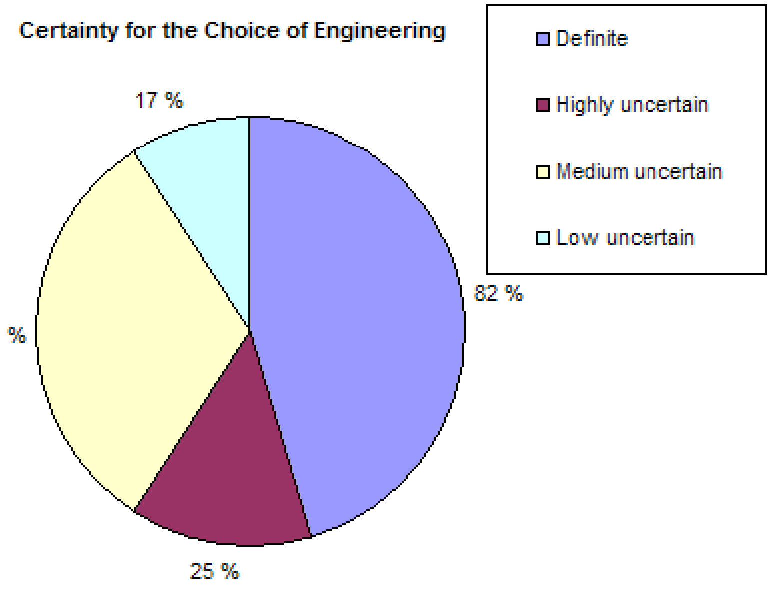
School pupils' views of civil engineering courses	Percent Importance
Tedious subject	2
Useful for practical applications	19
Difficulty subject	49
Interesting subject	20
Easy subject	0
Don't know much about civil engineering	10

School pupils' views of the civil engineering profession	Percent Importance
Responsible for environmental damage	13
Difficult job, not well paid	0
Gives the impression that everything can be calculated and explained	8
Useful for remediating environmental damage	13
Prestigious and well paid Profession	32
Useful for solving practical problems	22
Don't know much about civil engineering	11

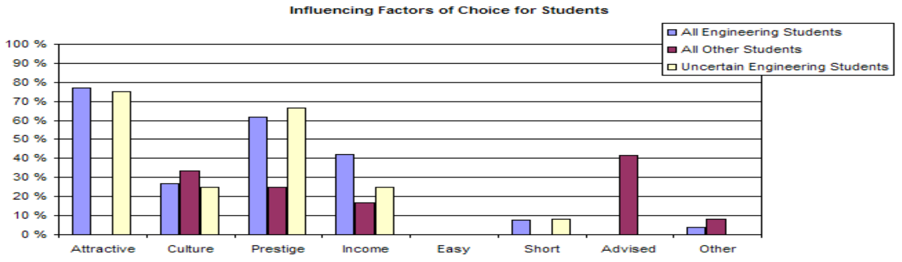
Data is also presented in the form of 5 graphics, set out below:

What type of studies are you interested in?

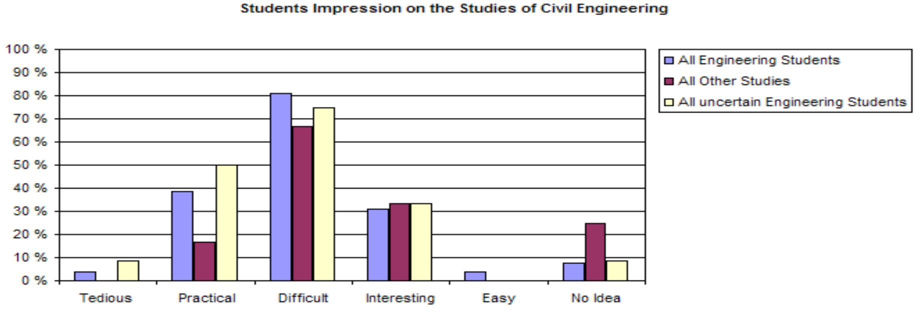




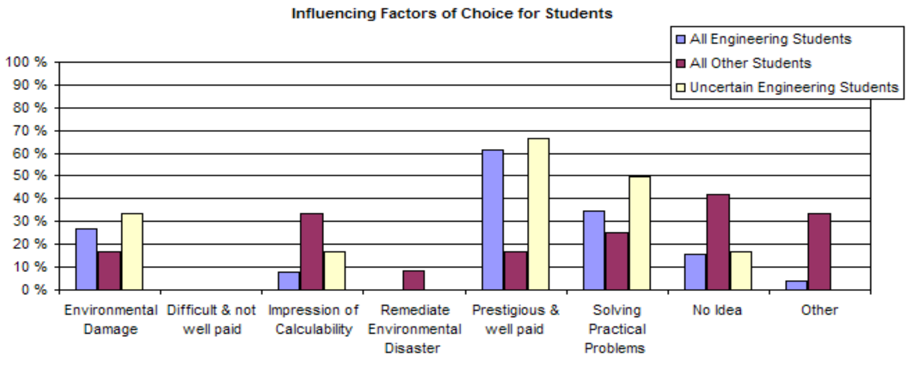
What factors have influenced your choice of university studies?



What factors have influenced your views of Civil Engineering courses?



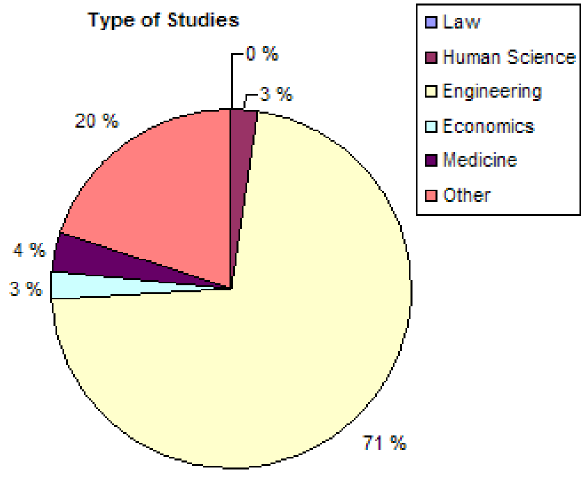
What factors have influenced your views of the Civil Engineering Profession?

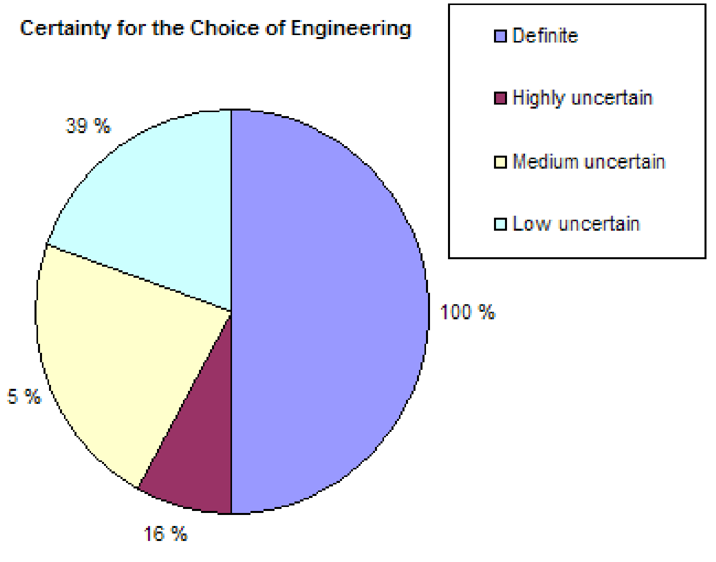


ITALY - Torino

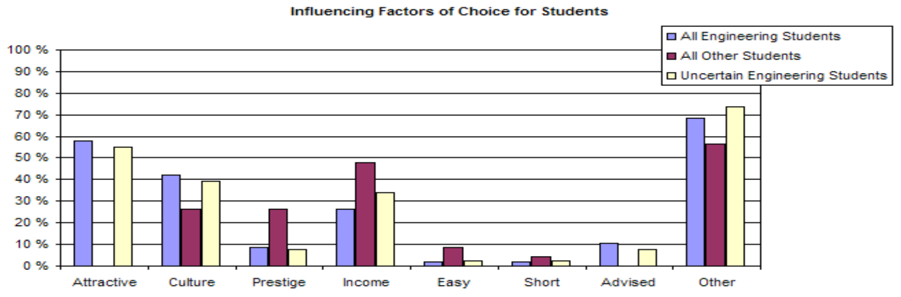
Colleagues at the Politecnico di Torino surveyed local school, and the data they collected is set out below graphically:

What type of studies are you interested in?

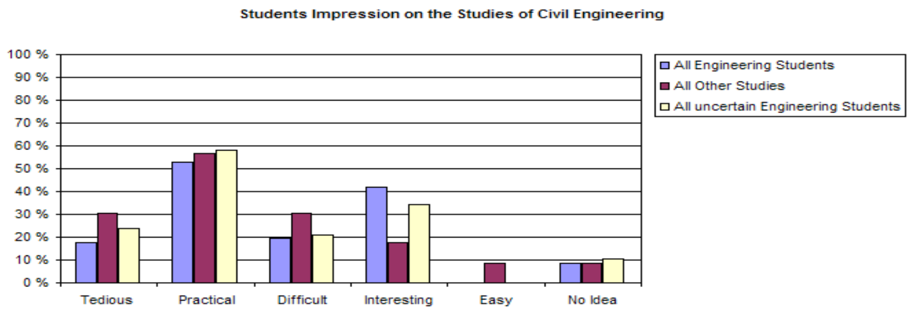




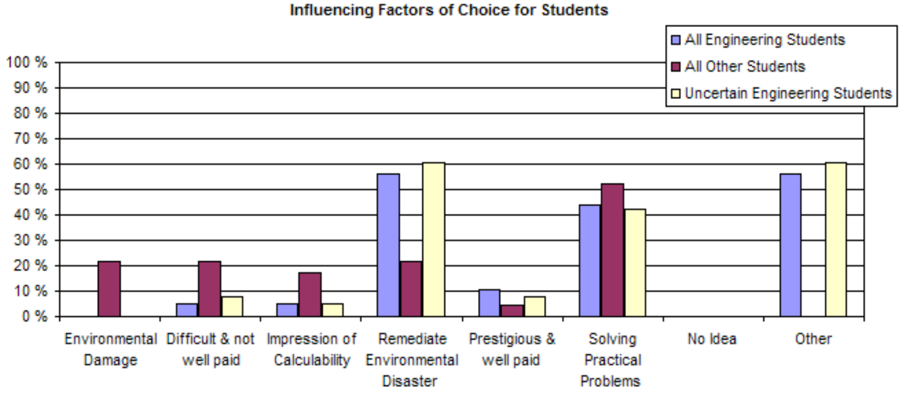
What factors have influenced your choice of university studies?



What factors have influenced your views on Civil Engineering courses?



What factors have influenced your views of the Civil Engineering Profession?



POLAND

Data provided by the TU Gliwice was divided into two groups; general secondary schools and vocational schools. There were 321 responses from general schools, of which 10% said they were interested in engineering and 60% that their plans for university education were definite. In the case of vocational schools, the sample was 55, 35% of which were interested in engineering and 35% definite about their university choice. Data for the two groups is tabulated below.

Secondary General Schools:

Factors influencing students' choice of university study	Percent Importance
Attractiveness of the Profession	22
Cultural interest	15
Prestige of the Profession	7
Possibility of high salaries	14
Ease of studies	2
Short duration of studies	0
Suggestions from parents/friends	5
Other factors (primarily personal interest)	35

School pupils' views of civil engineering courses	Percent Importance
Tedious subject	12
Useful for practical applications	25
Difficulty subject	17
Interesting subject	11
Easy subject	2
Don't know much about civil engineering	33

School pupils' views of the civil engineering profession	Percent Importance
Responsible for environmental damage	4
Difficult job, not well paid	8
Gives the impression that everything can be calculated and explained	29
Useful for remediating environmental damage	4
Prestigious and well paid Profession	8
Useful for solving practical problems	19
Don't know much about civil engineering	28

Vocational Schools

Factors influencing students' choice of university study	Percent Importance
Attractiveness of the Profession	17
Cultural interest	14
Prestige of the Profession	7

Possibility of high salaries	16
Ease of studies	10
Short duration of studies	6
Suggestions from parents/friends	5
Other factors (Primarily personal interest)	25

School pupils' views of civil engineering courses	Percent Importance
Tedious subject	9
Useful for practical applications	21
Difficulty subject	28
Interesting subject	21
Easy subject	2
Don't know much about civil engineering	19

School pupils' views of the civil engineering profession	Percent Importance
Responsible for environmental damage	7
Difficult job, not well paid	6
Gives the impression that everything can be calculated and explained	26
Useful for remediating environmental damage	4
Prestigious and well paid Profession	22
Useful for solving practical problems	23
Don't know much about civil engineering	12

PORTUGAL

Colleagues at the University of Beira Interior Covilha conducted the survey. A sample of 48 pupils was assessed, 43% of which expressed an interest in engineering, the rest favouring a wide choice of other subjects. 73% of the sample said that their choice was definite.

Factors influencing students' choice of university study	%age of Students selecting each Factor
Attractiveness of the Profession	88
Cultural interest	29
Prestige of the Profession	33
Possibility of high salaries	44
Ease of studies	4
Short duration of studies	2
Suggestions from parents/friends	23
Other factors (Primarily personal interest)	29

School pupils' views of civil engineering courses	%age of Students selecting each Factor
Tedious subject	6
Useful for practical applications	65
Difficulty subject	23
Interesting subject	29
Easy subject	0
Don't know much about civil engineering	33

School pupils' views of the civil engineering profession	%age of Students selecting each Factor
Responsible for environmental damage	21
Difficult job, not well paid	4
Gives the impression that everything can be calculated and explained	25
Useful for remediating environmental damage	23
Prestigious and well paid Profession	21
Useful for solving practical problems	63
Don't know much about civil engineering	40

ROMANIA - Technical University of Cluj Napoca

Cluj presented a sample of 40 responses, with a wide range of potential university subjects covered. 22% expressed interest in engineering and 33% said that their choice of study was definite. The data is tabulated below.

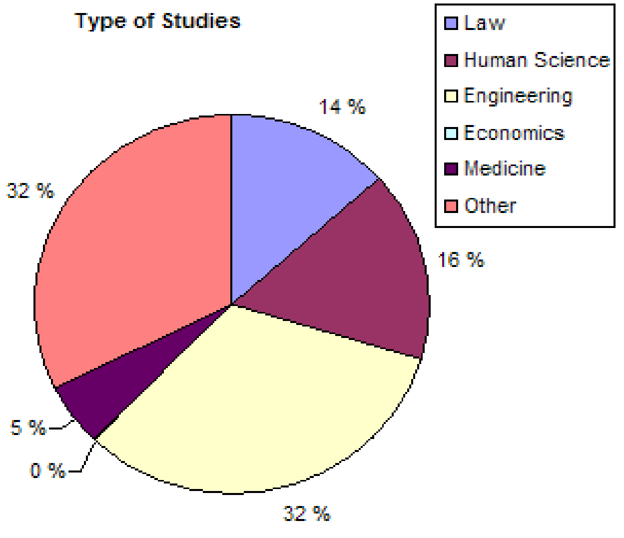
Factors influencing students' choice of university study	Percent Importance
Attractiveness of the Profession	22
Cultural interest	7
Prestige of the Profession	16
Possibility of high salaries	23
Ease of studies	1
Short duration of studies	1
Suggestions from parents/friends	16
Other factors	14

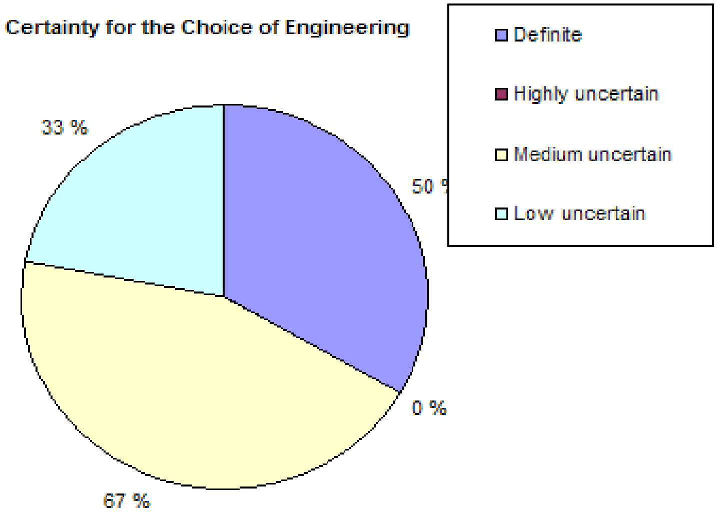
School pupils' views of civil engineering courses	Percent Importance
Tedious subject	12
Useful for practical applications	31
Difficulty subject	10
Interesting subject	22
Easy subject	3
Don't know much about civil engineering	21

School pupils' views of the civil engineering profession	Percent Importance
Responsible for environmental damage	1
Difficult job, not well paid	4
Gives the impression that everything can be calculated and explained	9
Useful for remediating environmental damage	8
Prestigious and well paid Profession	28
Useful for solving practical problems	28
Don't know much about civil engineering	22

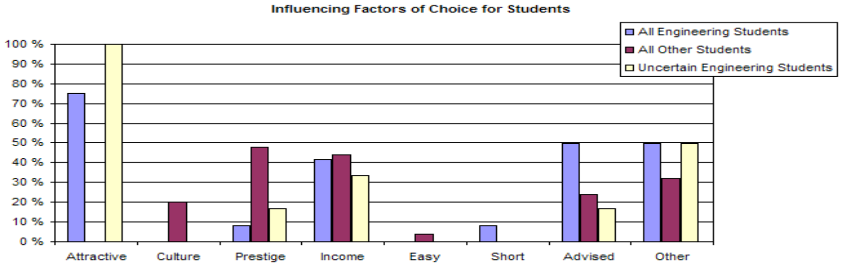
Data was also analysed graphically:

What type of studies are you interested in?

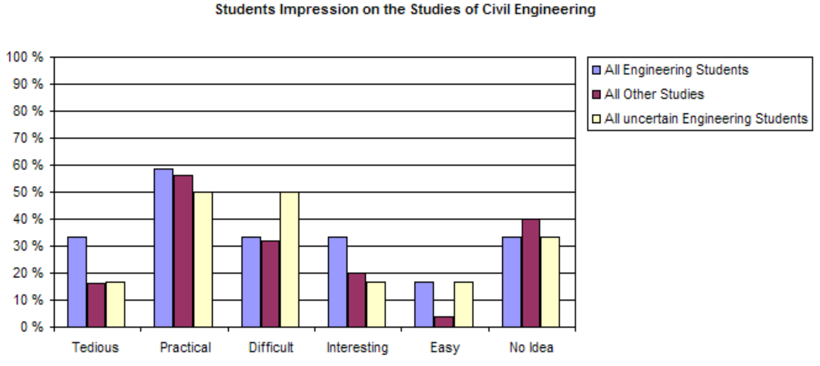




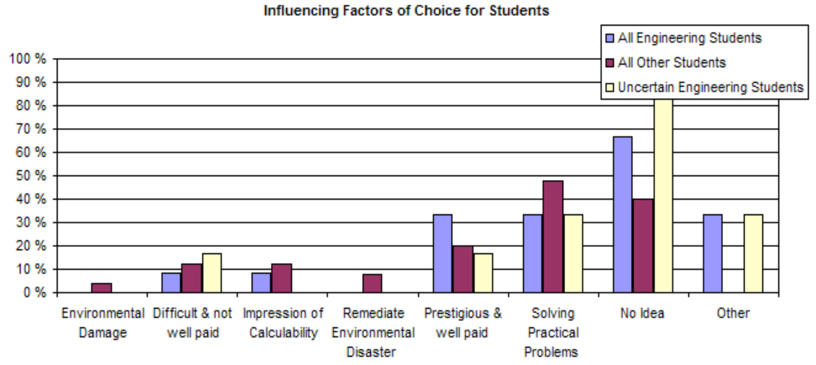
What factors have influenced your choice of university studies?



What factors have influenced your impressions of Civil Engineering courses?



What factors have influenced your views of the Civil Engineering Profession?



RO

98 replies were received, from 3 high schools, and data was treated as one set. 53% of respondents said that they were keen on engineering, the remainder were spread fairly evenly between other disciplines. 37% of respondents said that their choice of university study was definite. Data is tabulated below

Factors influencing students' choice of university study	Percent Importance
Attractiveness of the Profession	26
Cultural interest	7
Prestige of the Profession	8
Possibility of high salaries	27
Ease of studies	13
Short duration of studies	7
Suggestions from parents/friends	9
Other factors	3

School pupils' views of civil engineering courses	Percent Importance
Tedious subject	9
Useful for practical applications	34
Difficulty subject	25
Interesting subject	21
Easy subject	5
Don't know much about civil engineering	6

School pupils' views of the civil engineering profession	Percent Importance
Responsible for environmental damage	3
Difficult job, not well paid	17
Gives the impression that everything can be calculated and explained	19
Useful for remediating environmental damage	18
Prestigious and well paid Profession	21
Useful for solving practical problems	15
Don't know much about civil engineering	5

SLOVAK REPUBLIC

Colleagues at the University of Zilina conducted the survey. Data was divided into three groups, Grammar Schools, Secondary Professional Schools and Secondary Schools. The Grammar School sample comprised 204 responses, half of which expressed an interest in engineering, the other half was split between all other disciplines. Half the sample said that their choice was definite. The date is presented in tables below.

Factors influencing students' choice of university study	Percent Importance
Attractiveness of the Profession	34
Cultural interest	10
Prestige of the Profession	20
Possibility of high salaries	27
Ease of studies	4
Short duration of studies	0
Suggestions from parents/friends	3
Other factors	12

School pupils' views of civil engineering courses	Percent Importance
Tedious subject	6
Useful for practical applications	39
Difficulty subject	15
Interesting subject	25
Easy subject	0
Don't know much about civil engineering	13

School pupils' views of the civil engineering profession	Percent Importance
Responsible for environmental damage	4
Difficult job, not well paid	16
Gives the impression that everything can be calculated and explained	7
Useful for remediating environmental damage	8
Prestigious and well paid Profession	11
Useful for solving practical problems	43
Don't know much about civil engineering	11

The Secondary Professional Schools sample was 120, 90 of which were keen on engineering. 50% said that their choice of university subject was definite. Views on what influenced choice of study, civil engineering courses and the civil engineering profession are tabulated below.

Factors influencing students' choice of university study	Percent Importance
Attractiveness of the Profession	32
Cultural interest	3
Prestige of the Profession	22
Possibility of high salaries	22
Ease of studies	4
Short duration of studies	4
Suggestions from parents/friends	5
Other factors	12

School pupils' views of civil engineering courses	Percent Importance
Tedious subject	2
Useful for practical applications	36
Difficulty subject	27
Interesting subject	30
Easy subject	2
Don't know much about civil engineering	2

School pupils' views of the civil engineering profession	Percent Importance
Responsible for environmental damage	1
Difficult job, not well paid	14
Gives the impression that everything can be calculated and explained	8
Useful for remediating environmental damage	6
Prestigious and well paid Profession	20
Useful for solving practical problems	39
Don't know much about civil engineering	3

The third group of Slovak schools, Railway secondary school offered a small sample of 17 responses. Pupils chose a broad selection of subjects, and just over 50% of choices were described as definite. Views on important factors, courses and the profession are tabulated below.

Factors influencing students' choice of university study	Percent Importance
Attractiveness of the Profession	30
Cultural interest	0
Prestige of the Profession	26
Possibility of high salaries	20
Ease of studies	6
Short duration of studies	0
Suggestions from parents/friends	3
Other factors	12

School pupils' views of civil engineering courses	Percent Importance
Tedious subject	9
Useful for practical applications	22
Difficulty subject	30
Interesting subject	9
Easy subject	0
Don't know much about civil engineering	30

School pupils' views of the civil engineering profession	Percent Importance
Responsible for environmental damage	
Difficult job, not well paid	
Gives the impression that everything can be calculated and explained	10

Useful for remediating environmental damage	10
Prestigious and well paid Profession	16
Useful for solving practical problems	26
Don't know much about civil engineering	10

SPAIN

90 replies to questionnaires were submitted by UPC Barcelona, from schools which were well disposed towards the study of engineering, and civil engineering in particular; 81% said they were interested in engineering, the remainder being interested in a broad range of other disciplines. 50% of respondents said that their choice of university discipline was definite. Data is tabulated below.

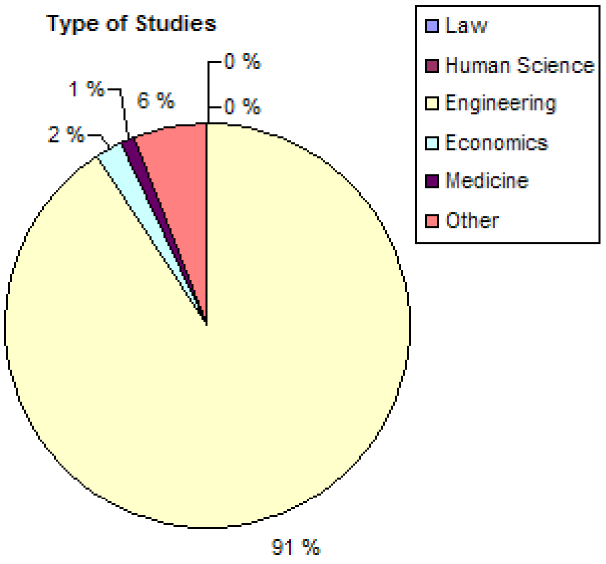
Factors influencing students' choice of university study	Percent Importance
Attractiveness of the Profession	39
Cultural interest	8
Prestige of the Profession	20
Possibility of high salaries	13
Ease of studies	2
Short duration of studies	1
Suggestions from parents/friends	7
Other factors	11

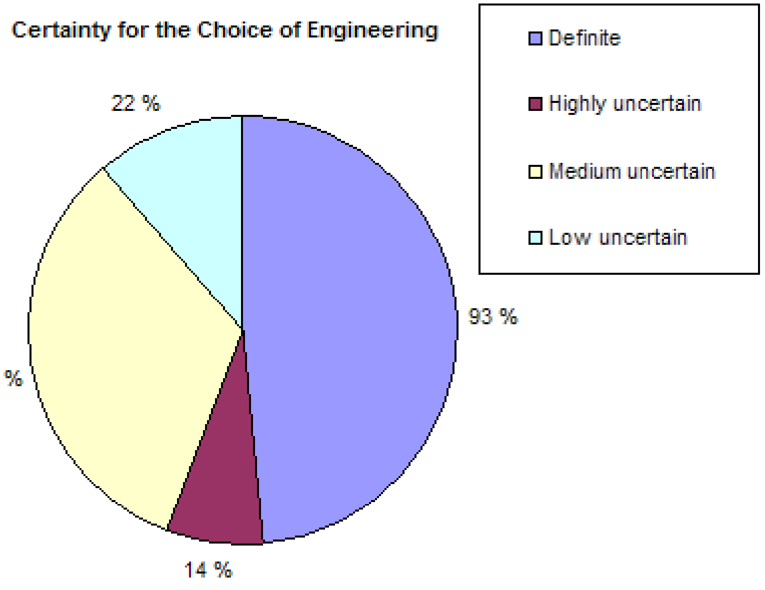
School pupils' views of civil engineering courses	Percent Importance
Tedious subject	4
Useful for practical applications	28
Difficulty subject	30
Interesting subject	32
Easy subject	2
Don't know much about civil engineering	5

School pupils' views of the civil engineering profession	Percent Importance
Responsible for environmental damage	16
Difficult job, not well paid	2
Gives the impression that everything can be calculated and explained	15
Useful for remediating environmental damage	8
Prestigious and well paid Profession	27
Useful for solving practical problems	29
Don't know much about civil engineering	3

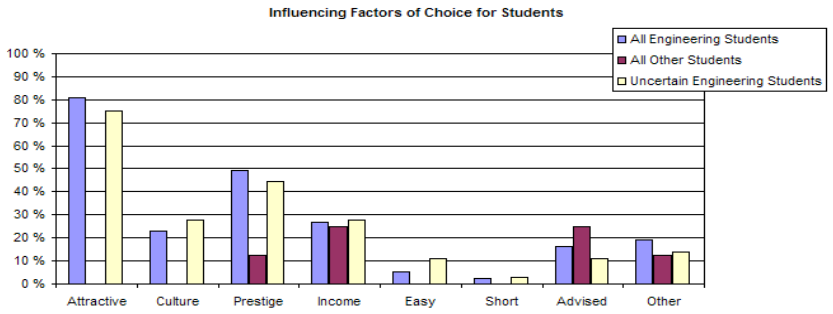
The Spanish schools data is also presented graphically below.

What type of studies are you interested in?

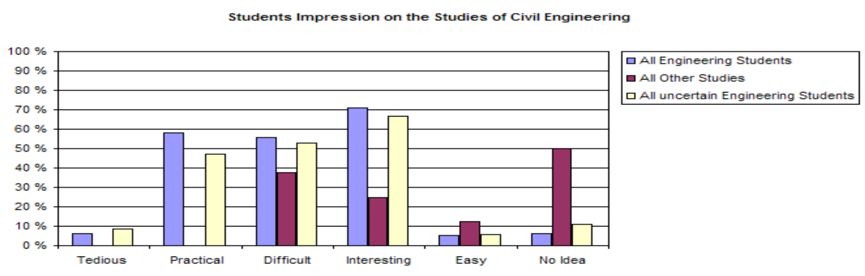




What factors have influenced your choice of university studies?



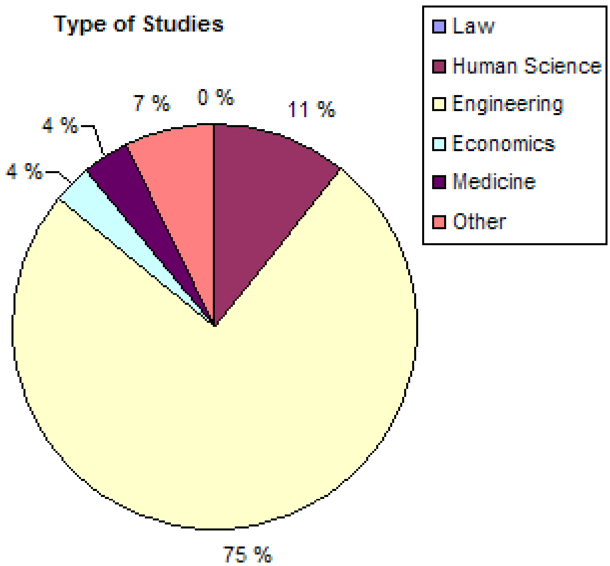
What factors have influenced your views of Civil Engineering courses?

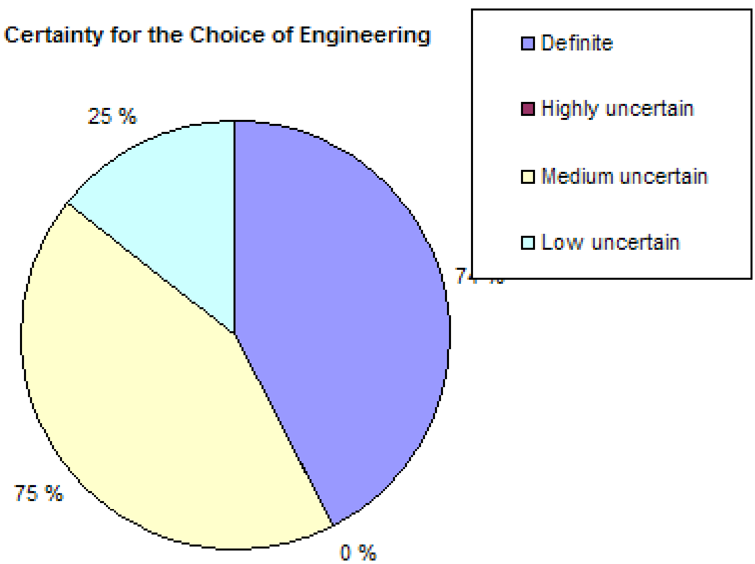


TURKEY

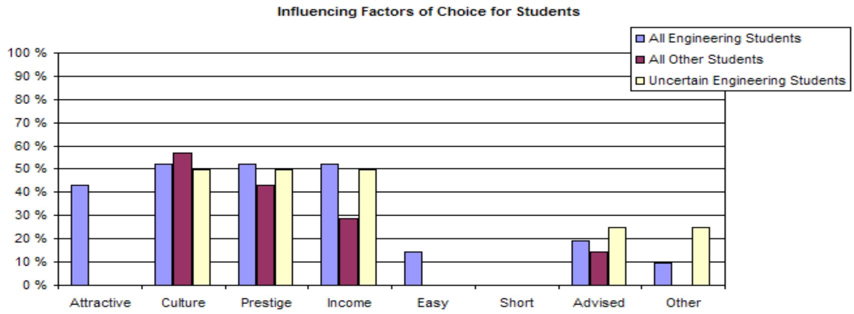
Colleagues from the Middle Eastern Technical University at Ankara conducted the survey. Data are presented in a graphical format:

What type of studies are you interested in?

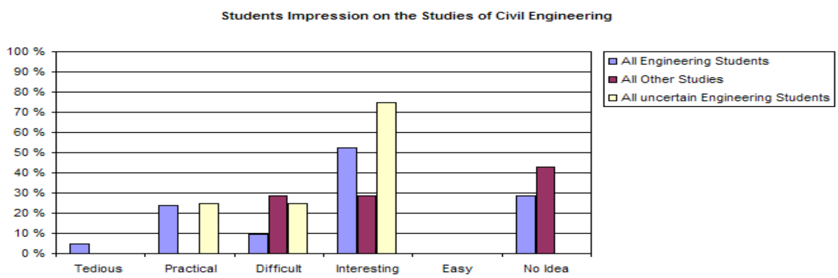




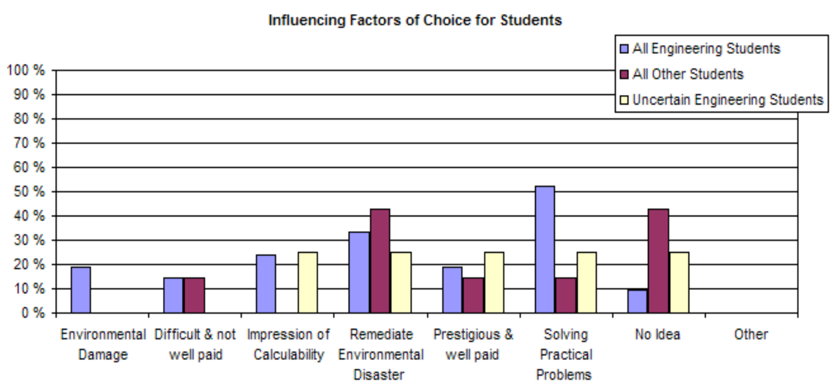
What factors have influenced your choice of university study?



What factors have influenced your views on Civil Engineering courses?



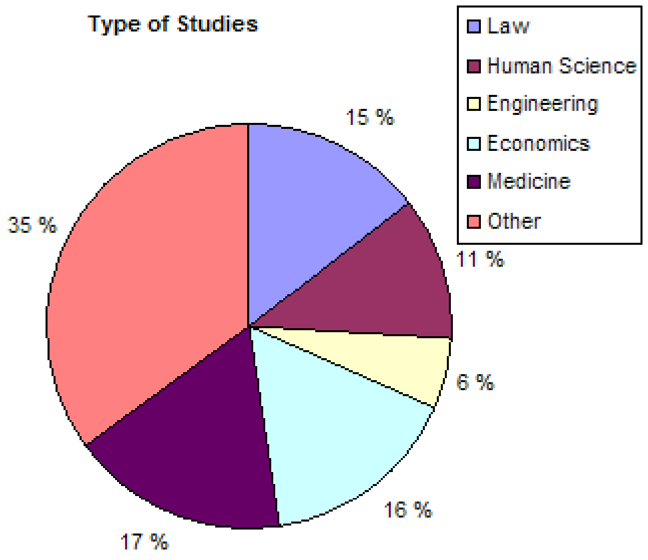
What factors have influenced your views on the Civil Engineering Profession?

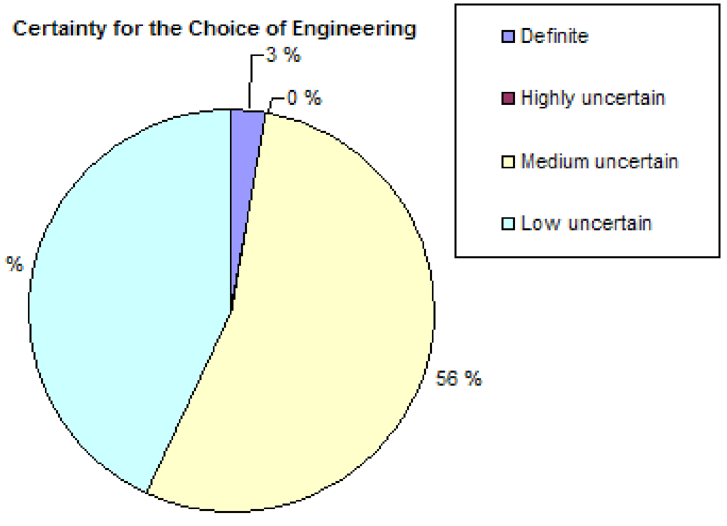


UNITED KINGDOM

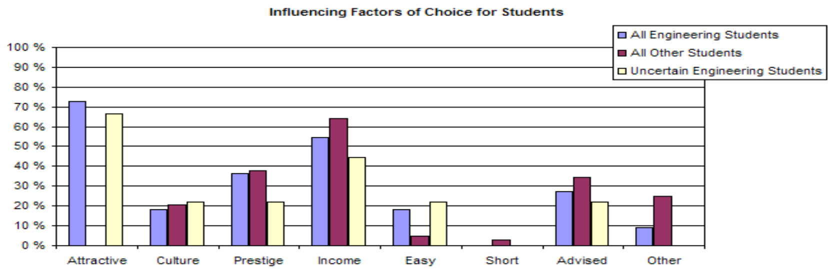
Data from 4 schools was collected by Imperial College, the total sample being 450. Data is presented graphically below.

What type of studies are you interested in?

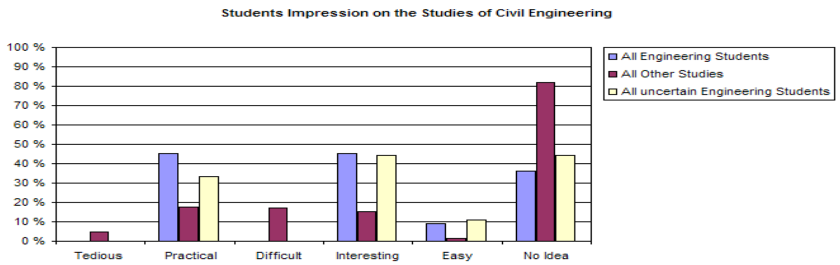




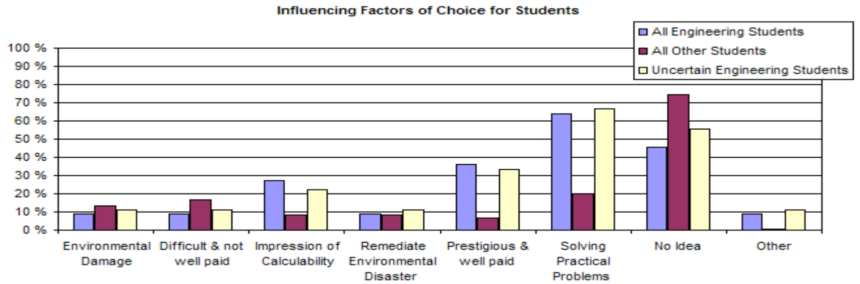
What factors influenced your choice of university studies?



What factors influenced your views about Civil Engineering courses?



What factors influenced your views of the Civil Engineering Profession?



APPENDIX C

QUESTIONNAIRE AND DATA FROM UNIVERSITY STUDENTS

EUCEET colleagues surveyed a number of first year students, studying a range of subjects, to determine which factors influenced their choice of studies. Students were asked to rate the importance of 8 factors on a scale of Very Important-Important-Neutral-Less Important-Not Important. The responses for Very Important - Important, and Less Important-Not Important were grouped, and the percentage of each group was tabulated for each factor. Students were also asked to rate their perceptions of civil engineering on a scale of 5 (exciting) to 1 (boring). Finally, they were asked about the extent to which they strongly agreed or strongly disagreed with a number of propositions about the Civil Engineering Profession. Results were grouped into two; Strong Agreement – Agreement and Disagreement – Strong Disagreement, and the numbers for each of the two categories was recorded as a percentage. These results were presented in three tables for each university.

EUROPEAN CIVIL ENGINEERING EDUCATION AND TRAINING

SP9: ENHANCING THE ATTRACTIVENESS OF THE CIVIL ENGINEERING PROFESSION

Questionnaire to Autumn 2003 University Student Intake

Background

Students applying to study Civil Engineering at University are becoming less abundant across much of the EU. Some of this may be due to demographics, some to lower social status and earning opportunities of engineering graduates compared to other professions, and some of it may be due to other factors related to 'fashion' and increasing competition for mathematically able students. In some countries the popularity of Civil Engineering courses may be increasing.

SP9 is considering this issue as part of an EU investigation into why people study various subjects (or choose not to study certain subjects). We are therefore conducting a survey to gain some indication of what attracted students to study for a Civil Engineering degree and also to find why students who chose other similar degrees decided against Civil Engineering. We are VERY interested in your opinions, so please spend a few minutes filing in the following Questionnaire. We are seeking your help, as new university students, studying many different topics, to understand these questions. Your help is much appreciated.

EUCEET SP9 Committee

1. In which country are you studying?

2. Which of the following groups best describes the course you are studying? Please mark 'x'.

	Civil Engineering
	Construction
	Mechanical Engineering
	Electrical engineering
	Aeronautical Engineering
	Law
	Computing
	Natural Sciences (Physics, Chemistry, biology etc)
	Earth or Environmental Sciences (Geology, Geophysics, Environmental Science)
	Medicine
	Economics/Business studies

1. Previous (School) Studies (Please mark 'x')

Did you study Mathematics to age?

	14
	16
	18

Did you study Physics to age?

	14
	16
	18

Did you study chemistry to age?

	14
	16
	18

Did you study an arts subject e.g. Geography, History, Law, Social Studies, Economics to age 18+?
If so which one(s)?

✎

3. Please indicate which factors were important for you in making your choice of degree course, by marking 'x' in the appropriate boxes.

	Very Important	Important	In the middle	Less important	Not at all important
Cultural interest					
Prestige of the profession					
Attractiveness of the profession					
Salary					
Relevance to the public interest					
Easiness of study					
Short duration of study					
Suggestion by parents/friends					
Others: Please Specify ___________________					

4. If you had not chosen your current course what would your next choice have been? (Please mark 'x')

	Civil Engineering
	Construction
	Mechanical Engineering
	Electrical engineering
	Aeronautical Engineering
	Law
	Computing
	Natural Sciences (Physics, Chemistry, biology etc)
	Earth or Environmental Sciences (Geology, Geophysics, Environmental Science)
	Medicine
	Economics/Business studies

5. Please rate how boring you think each of the following are by marking ‘x’ in the appropriate boxes.
1=boring, 5=exciting

	5	4	3	2	1
Civil Engineering					
Construction					
Mechanical Engineering					
Electrical engineering					
Aeronautical Engineering					
Law					
Computing					
Natural Sciences (physics, chemistry, biology etc…)					
Earth or Environmental Sciences (Geology, Geophysics, Environmental Science					
Medicine					
Economics/Business Studies					

6. Whether or not you have chosen to study Civil Engineering, please tell us what you think about the Civil Engineering Profession, by marking ‘x’ in the appropriate boxes.

	Totally Agree	Agree	In the Middle	Disagree	Disagree Strongly
Difficult job					
Dirty job					
Not well paid					
Responsible for environmental damage					
Prestigious profession					
Solving infrastructure problems					
Forward looking profession					
Uses advanced IT					
Opportunities for international work					
Job mobility					
Team work					
Cooperation with other professions					
Political involvement					

CZECH REPUBLIC - Prague Technical University

A sample of 65 students studying civil engineering and earth sciences was assessed. 91% had studied mathematics to age 18, 63% physics and 28% chemistry. There was a reasonable spread of humanities subjects across the sample which had also been studied to age 18. Data is presented below:

Factors influencing student choice	Important/Very important (%)	Less Important/Not important (%)
Cultural interest	61	21
Prestige of the Profession	10	23
Attractiveness of the Profession	51	18
Possibility of high salaries	36	10
Relevance to the public interest	37	28
Easiness of studies	16	45
Short duration	0	0
Suggestions from parents/friends	8	86

Exciting:	5	4	3	2	1	Boring
%	16	32	40	4	8	

Students' views of the Civil Engineering Profession	Totally Agree/Agree	Disagree/Disagree Strongly
Difficult job	58	4
Dirty job	8	60
Not well paid	17	13
Responsible for environmental damage	12	29
Prestigious profession	56	8
Solves infrastructure problems	87	8
Forward looking Profession	92	4
Uses advanced IT	87	4
Opportunities for international work	96	0
Offers job mobility	58	17
Involves team work	61	0
Involves cooperation with other professions	92	0
Has political involvement	13	68

CZECU REPUBLIC - Pardubice Technical University

50 responses were received from a mixture of students, 56% studying mechanical engineering, 10% economics and 34% construction. All had studied mathematics to the age of 18, 98% had studies physics to age 18 and 46% had studied chemistry to the same age. Most of the students had studies a humanities subject, usually geography or history. Results were not summarised in quite the same way as in other cases. Here, the factors influencing choice and the views on the profession ranked, and they are tabulated below.

Factors influencing choice of studies	Rank
Opportunity for high salaries	1
Prestige of the profession	2
Suggestions by parents/friends	3
Relevance to the public interest	4

Views of the civil engineering profession	Rank
Difficult work	1
Uses advanced IT	2
Solves infrastructure problems	3
Offers cooperation with other professions	4

DENMARK - Engineering College of Odense

A sample of 15 students studying construction was considered, of which 60% had done mathematics to age 18, 47% physics, 47 % chemistry. Only 3 students had studied humanities to this age. Data is tabulated below

Factors influencing student choice	Important/Very important (%)	Less Important/Not important (%)
Cultural interest	39	26
Prestige of the Profession	33	27
Attractiveness of the Profession	67	27
Possibility of high salaries	53	13
Relevance to the public interest	33	25
Easiness of studies	0	59
Short duration	10	60
Suggestions from parents/friends	10	66

Exciting:	5	4	3	2	1	Boring
%	33	26	41	0	0	

Students' views of the Civil Engineering Profession	Totally Agree/Agree	Disagree/Disagree Strongly
Difficult job	86	0
Dirty job	0	80
Not well paid	0	80
Responsible for environmental damage	33	33
Prestigious profession	53	0
Solves infrastructure problems	59	1
Forward looking Profession	73	6
Uses advanced IT	53	6
Opportunities for international work	87	6
Offers job mobility	67	6
Involves team work	87	0
Involves cooperation with other professions	80	6
Has political involvement	39	13

ESTONIA - Technical University, Tallinn

Two sets of data were provided, one from a sample of 130 students doing civil engineering, the second a sample of 33 doing computing. Among the civil engineers, 94% had done mathematics and physics to the age of 18 and most had also studied a humanities subject to this age. Amongst the computing students, almost all had done maths and physics to age 18, a few had also done chemistry, and most had studies a humanities subject as well. Data is presented in two sets of tables, below.

Civil Engineering Students

Factors influencing student choice	Important/Very important (%)	Less Important/Not important (%)
Cultural interest	37	37
Prestige of the Profession	67	12
Attractiveness of the Profession	75	5
Possibility of high salaries	86	4
Relevance to the public interest	43	20
Easiness of studies	15	60
Short duration	11	72
Suggestions from parents/friends	17	57

Exciting:	5	4	3	2	1	Boring
%	60	23	25	1	1	

Students' views of the Civil Engineering Profession	Totally Agree/Agree	Disagree/Disagree Strongly
Difficult job	81	3
Dirty job	13	53
Not well paid	9	70
Responsible for environmental damage	60	16
Prestigious profession	78	2
Solves infrastructure problems	57	11
Forward looking Profession	82	2
Uses advanced IT	68	0
Opportunities for international work	85	1
Offers job mobility	73	3
Involves team work	86	2
Involves cooperation with other professions	85	1
Has political involvement	30	29

Computing Students

Factors influencing student choice	Important/Very important (%)	Less Important/Not important (%)
Cultural interest	24	60
Prestige of the Profession	63	10
Attractiveness of the Profession	81	6
Possibility of high salaries	84	0
Relevance to the public interest	30	30
Easiness of studies	18	30
Short duration	3	66
Suggestions from parents/friends	18	51

Exciting:	5	4	3	2	1	Boring
%	6	19	45	22	6	

Students' views of the Civil Engineering Profession	Totally Agree/Agree	Disagree/Disagree Strongly
Difficult job	73	3
Dirty job	7	39
Not well paid	20	34
Responsible for environmental damage	55	14
Prestigious profession	32	18
Solves infrastructure problems	55	0
Forward looking Profession	65	3
Uses advanced IT	30	7
Opportunities for international work	71	7
Offers job mobility	57	4
Involves team work	75	0
Involves cooperation with other professions	62	7
Has political involvement	37	30

GREECE - National Technological University, Athens

26 responses were received. All but one student had studies mathematics and physics to age 18 and 73% had studied a humanities subject. Data is tabulated below.

Factors influencing student choice	Important/Very important (%)	Less Important/Not important (%)
Cultural interest	43	27
Prestige of the Profession	54	16
Attractiveness of the Profession	81	8
Possibility of high salaries	85	4
Relevance to the public interest	54	4
Easiness of studies	4	75
Short duration	8	74
Suggestions from parents/friends	16	58

Exciting:	5	4	3	2	1	Boring
%	54	23	12	0	0	

Students' views of the Civil Engineering Profession	Totally Agree/Agree	Disagree/Disagree Strongly
Difficult job	77	4
Dirty job	20	39
Not well paid	4	61
Responsible for environmental damage	28	42
Prestigious profession	73	0
Solves infrastructure problems	84	4
Forward looking Profession	85	0
Uses advanced IT	81	0
Opportunities for international work	70	8
Offers job mobility	69	12
Involves team work	55	15
Involves cooperation with other professions	85	0
Has political involvement	43	39

HOLLAND - TU Delft

The size of the sample was not known (need to check with Ellen). All were doing civil engineering or construction. The data is presented in three tables below.

Factors influencing student choice	Important/Very important (%)	Less Important/Not important (%)
Cultural interest	34	34
Prestige of the Profession	66	3
Attractiveness of the Profession	84	3
Possibility of high salaries	35	22
Relevance to the public interest	47	22
Easiness of studies	0	69
Short duration	0	91
Suggestions from parents/friends	16	41

Exciting:	5	4	3	2	1	Boring
%	88	13	0	0	0	

Students' views of the Civil Engineering Profession	Totally Agree/Agree	Disagree/Disagree Strongly
Difficult job	66	0
Dirty job	6	72
Not well paid	9	60
Responsible for environmental damage	41	31
Prestigious profession	65	6
Solves infrastructure problems	88	12
Forward looking Profession	80	0
Uses advanced IT	22	25
Opportunities for international work	93	3
Offers job mobility	75	0
Involves team work	97	0
Involves cooperation with other professions	84	0
Has political involvement	50	13

HUNGARY - Budapest University of Technology and Economics

A sample of 198 students were surveyed. 30% were studying civil engineering, the remainder studying a range of science, engineering and economics subjects. 97% had studies mathematics to age 18, 87% physics and 20% chemistry. Data is tabulated below. However, a different grading system was used to analyse this set of data. Low numbers indicate agreement with the factor or view, high numbers indicate disagreement.

Factors influencing student choice	Civil Engineering students	Other Students
Cultural interest	3.11	2.96
Prestige of the Profession	2.18	2.26
Attractiveness of the Profession	1.96	1.92
Possibility of high salaries	2.02	2.12
Relevance to the public interest	3.39	3.45
Easiness of studies	3.84	3.77
Short duration	4.16	4.16
Suggestions from parents/friends		

Students' views of the Civil Engineering Profession	Civil Engineering Students	Other Students
Difficult job	2.39	2.35
Dirty job	3.18	2.98
Not well paid	3.88	3.60
Responsible for environmental damage	3.85	3.60
Prestigious profession	3.44	3.48
Solves infrastructure problems	2.03	2.02
Forward looking Profession	2.03	1.87
Uses advanced IT	2.64	2.55
Opportunities for international work	1.97	2.06
Offers job mobility	2.61	2.76
Involves team work	2.27	2.17
Involves cooperation with other professions	2.03	2.19
Has political involvement		

ITALY - Universita di Firenze

Data from a sample of 43 undergradutes was collected from students at the Universita di Firenze. The sample included a wide range of engineering students. 32% had studied maths to age 18, 30 physics and 23 % chemistry. In general, students had a good background in humanities subjects. Data is tabulated below.

Factors influencing student choice	Important/Very important (%)	Less Important/Not important (%)
Cultural interest	91	2
Prestige of the Profession	68	9
Attractiveness of the Profession	90	0
Possibility of high salaries	79	4
Relevance to the public interest	49	21
Easiness of studies	4	63
Short duration	2	65
Suggestions from parents/friends	8	63

Exciting:	5	4	3	2	1	Boring
%	9	26	40	21	5	

Students' views of the Civil Engineering Profession	Totally Agree/Agree	Disagree/Disagree Strongly
Difficult job	58	5
Dirty job	5	60
Not well paid	9	60
Responsible for environmental damage	58	23
Prestigious profession	65	0
Solves infrastructure problems	86	2
Forward looking Profession	44	9
Uses advanced IT	21	5
Opportunities for international work	47	21
Offers job mobility	34	14
Involves team work	65	2
Involves cooperation with other professions	81	0
Has political involvement	21	42

ITALY - Politecnico di Milano

A sample of 37 students studying mechanical engineering was studied. 43% had done mathematics to age 18, 40% physics and 27% chemistry. There was no indication of the background the students had in humanities. Data is tabulated below:

Factors influencing student choice	Important/Very important (%)	Less Important/Not important (%)
Cultural interest	70	2
Prestige of the Profession	81	8
Attractiveness of the Profession	89	0
Possibility of high salaries	72	5
Relevance to the public interest	27	5
Easiness of studies	2	78
Short duration	2	78
Suggestions from parents/friends	14	72

Exciting:	5	4	3	2	1	Boring
%	11	32	38	14	5	

Students' views of the Civil Engineering Profession	Totally Agree/Agree	Disagree/Disagree Strongly
Difficult job	57	8
Dirty job	8	49
Not well paid	5	44
Responsible for environmental damage	54	18
Prestigious profession	46	11
Solves infrastructure problems	65	8
Forward looking Profession	34	16
Uses advanced IT	30	27
Opportunities for international work	54	18
Offers job mobility	51	22
Involves team work	62	10
Involves cooperation with other professions	67	2
Has political involvement	35	33

PORTUGAL - Technical University of Beira Interior Covilha

A sample of 40 civil engineering students was studied, 93% of whom had done mathematics to age 18, 25% physics and 24% chemistry. A small number had also studied humanities to this age, but not many. Data is tabulated below:

Factors influencing student choice	Important/Very important (%)	Less Important/Not important (%)
Cultural interest	29	2
Prestige of the Profession	33	0
Attractiveness of the Profession	33	0
Possibility of high salaries	28	0
Relevance to the public interest	16	8
Easiness of studies	0	0
Short duration	5	22
Suggestions from parents/friends	8	20

Exciting:	5	4	3	2	1	Boring
%	59	41	0	0	0	

Students' views of the Civil Engineering Profession	Totally Agree/Agree	Disagree/Disagree Strongly
Difficult job	78	4
Dirty job	29	31
Not well paid	21	48
Responsible for environmental damage	53	22
Prestigious profession	86	0
Solves infrastructure problems	95	0
Forward looking Profession	67	0
Uses advanced IT	0	0
Opportunities for international work	66	0
Offers job mobility	77	0
Involves team work	63	5
Involves cooperation with other professions	76	3
Has political involvement	23	38

ROMANIA - Technical University of Cluj Napoca

Two sets of data were submitted, a sample of 20 replies from the civil engineering faculty and 10 from the economics faculty. All the engineers had studied mathematics to age 18, 85% physics and 80% chemistry, but only 20% had studies humanities to this age. Amongst the economists, all had done maths, physics and chemistry, and 30% had done humanities. Data is presented below for the two groups.

Civil engineering students

Factors influencing student choice	Important/Very important (%)	Less Important/Not important (%)
Cultural interest	45	15
Prestige of the Profession	100	0
Attractiveness of the Profession	100	0
Possibility of high salaries	90	0
Relevance to the public interest	65	0
Easiness of studies	0	70
Short duration	0	100
Suggestions from parents/friends	25	25

Exciting:	5	4	3	2	1	Boring
%	55	25	20	0	0	

Students' views of the Civil Engineering Profession	Totally Agree/Agree	Disagree/Disagree Strongly
Difficult job	80	0
Dirty job	5	65
Not well paid	0	80
Responsible for environmental damage	30	30
Prestigious profession	95	0
Solves infrastructure problems	100	0
Forward looking Profession	100	0
Uses advanced IT	75	15
Opportunities for international work	75	15
Offers job mobility	90	0
Involves team work	95	5
Involves cooperation with other professions	95	0
Has political involvement	35	30

Economics Students

Factors influencing student choice	Important/Very important (%)	Less Important/Not important (%)
Cultural interest	60	10
Prestige of the Profession	80	0
Attractiveness of the Profession	100	0
Possibility of high salaries	80	0
Relevance to the public interest	50	10
Easiness of studies	10	90
Short duration	0	100
Suggestions from parents/friends	10	70

Exciting:	5	4	3	2	1	Boring
%	0	40	40	0	20	

Students' views of the Civil Engineering Profession	Totally Agree/Agree	Disagree/Disagree Strongly
Difficult job	90	0
Dirty job	0	70
Not well paid	0	70
Responsible for environmental damage	0	60
Prestigious profession	30	10
Solves infrastructure problems	70	0
Forward looking Profession	0	30
Uses advanced IT	40	20
Opportunities for international work	80	0
Offers job mobility	90	0
Involves team work	90	0
Involves cooperation with other professions	70	10
Has political involvement	10	60

ROMANIA - Technical University of Timisoara

Replies were received from 155 students studying civil engineering. All had studies mathematics to the age of 18, and 83% had studied physics and chemistry to the same age. A very small number, 2 or 3%, had studies a humanities subject to the same age. Data is tabulated below.

Factors influencing student choice	Important/Very important (%)	Less Important/Not important (%)
Cultural interest	46	19
Prestige of the Profession	95	0
Attractiveness of the Profession	84	10
Possibility of high salaries	93	0
Relevance to the public interest	51	22
Easiness of studies	0	78
Short duration	59	24
Suggestions from parents/friends	79	14

Exciting:	5	4	3	2	1	Boring
%	0	10	76	14	0	

Students' views of the Civil Engineering Profession	Totally Agree/Agree	Disagree/Disagree Strongly
Difficult job	65	16
Dirty job	22	44
Not well paid	45	27
Responsible for environmental damage	11	78
Prestigious profession	51	34
Solves infrastructure problems	67	19
Forward looking Profession	55	21
Uses advanced IT	41	20
Opportunities for international work	56	13
Offers job mobility	56	18
Involves team work	54	16
Involves cooperation with other professions	67	8
Has political involvement	39	11

SLOVAK REPUBLIC - Technical University of Zilina

91 responses were received, from a group of students studying civil engineering or construction. Almost all had studies mathematics to the age of 18, 30 had studied physics and a small number had studies chemistry. There was also a good spread of humanities subjects studied to the age of 18. The data is presented in thee tables below.

Factors influencing student choice	Important/Very important (%)	Less Important/Not important (%)
Cultural interest	48	17
Prestige of the Profession	64	11
Attractiveness of the Profession	57	16
Possibility of high salaries	58	6
Relevance to the public interest	20	45
Easiness of studies	15	48
Short duration	11	51
Suggestions from parents/friends	18	61

Exciting:	5	4	3	2	1	Boring
%	37	35	25	1	2	

Students' views of the Civil Engineering Profession	Totally Agree/Agree	Disagree/Disagree Strongly
Difficult job	79	6
Dirty job	29	36
Not well paid	20	35
Responsible for environmental damage	28	33
Prestigious profession	53	5
Solves infrastructure problems	52	10
Forward looking Profession	44	17
Uses advanced IT	45	13
Opportunities for international work	76	3
Offers job mobility	81	2
Involves team work	80	1
Involves cooperation with other professions	74	3
Has political involvement	33	24

SPAIN - UPC Barcelona

Data was submitted from 100 civil engineering students. 82% had studied mathematics to age 18, 76% physics and 62% chemistry. 80% had also studies a humanities subject to age 18. Data is tabulated below.

Factors influencing student choice	Important/Very important (%)	Less Important/Not important (%)
Cultural interest	52	8
Prestige of the Profession	76	4
Attractiveness of the Profession	89	1
Possibility of high salaries	85	9
Relevance to the public interest	47	12
Easiness of studies	8	71
Short duration	9	78
Suggestions from parents/friends	19	60

Exciting:	5	4	3	2	1	Boring
%	69	21	2	0	1	

Students' views of the Civil Engineering Profession	Totally Agree/Agree	Disagree/Disagree Strongly
Difficult job	80	5
Dirty job	15	53
Not well paid	16	69
Responsible for environmental damage	64	8
Prestigious profession	79	6
Solves infrastructure problems	79	0
Forward looking Profession	66	5
Uses advanced IT	52	9
Opportunities for international work	73	2
Offers job mobility	72	6
Involves team work	69	8
Involves cooperation with other professions	56	10
Has political involvement	58	13

TURKEY - Middle Eastern University, Ankara

Colleagues at the Middle Eastern University surveyed 112 students, 77% of whom were studying civil engineering. 65% had studied mathematics, physics and chemistry to the age of 18 and a similar percentage had also studied a humanities subject to this age. Data is tabulated below.

Factors influencing student choice	Important/Very important (%)	Less Important/Not important (%)
Cultural interest	61	13
Prestige of the Profession	70	8
Attractiveness of the Profession	70	8
Possibility of high salaries	88	10
Relevance to the public interest	55	11
Easiness of studies	24	38
Short duration	21	45
Suggestions from parents/friends	28	34

Exciting:	5	4	3	2	1	Boring
%	40	32	14	5	9	

Students' views of the Civil Engineering Profession	Totally Agree/Agree	Disagree/Disagree Strongly
Difficult job	71	5
Dirty job	49	26
Not well paid	28	36
Responsible for environmental damage	43	33
Prestigious profession	48	8
Solves infrastructure problems	58	5
Forward looking Profession	62	10
Uses advanced IT	57	5
Opportunities for international work	70	6
Offers job mobility	59	8
Involves team work	81	6
Involves cooperation with other professions	77	7
Has political involvement	38	33

UNITED KINGDOM - Imperial College London

300 questionnaires were circulated to first year students via contacts within each Department. Some departments were very happy to pass them on to students and encourage them to participate. Others were not willing to do this, feeling that such a survey was either irrelevant or that students would not respond. The actual response fro student was very small. Only 17 replies were received, from a broad range of departments. All were studying technical/scientific/engineering subjects, and would be expected of a technical university. All respondents had studied mathematics to age 18, 88% of which had also studied physics and 41% a humanities subject.

Factors influencing student choice	Important/Very important (%)	Less Important/Not important (%)
Cultural interest	20	39
Prestige of the Profession	65	18
Attractiveness of the Profession	87	0
Possibility of high salaries	70	18
Relevance to the public interest	58	24
Ease of studies	23	59
Duration of studies	6	76
Suggestions by parents/friends	35	52

Exciting:	5	4	3	2	1	Boring
%	0	12	35	29	23	

Students' views of the Civil Engineering Profession	Totally Agree/Agree	Disagree/Disagree Strongly
Difficult job	41	12
Dirty job	23	30
Not well paid	18	24
Responsible for environmental damage	18	53
Prestigious profession	30	24
Solves infrastructure problems	65	6
Forward looking Profession	24	13
Uses advanced IT	30	24
Opportunities for international work	72	18
Offers job mobility	59	6
Involves team work	82	0
Involves cooperation with other professions	71	6
Has political involvement	18	24

Report of the **Working Group** for the Specific Project 12

Lifelong learning in civil engineering

LIFELONG LEARNING IN CIVIL ENGINEERING

Pericles Latinopoulos[1]

'A person who graduated yesterday and stops studying today is uneducated tomorrow'
unknown origin

1. INTRODUCTION

1.1 Objectives

Civil engineers constitute one of the very specific groups of today's society, as they need an active and constant engagement in lifelong learning (LLL) activities, not only for the benefit of their personal and/or career development, but also because their profession is aiming to serve the modern world in a straightforward and global way. In our days a civil engineer is not only a designer, a planner or a constructor. He is also a producer, a decision-maker and, probably, a leader. In order to succeed in such a multifarious ensemble of professional tasks, the civil engineer should constantly acquire a planned combination of knowledge, experience and skills as well as develop his individual qualities and competences.

The present report aims at bringing together in a concise way and from within a European perspective the basic issues that are relevant to the participation of this specific professional group (i.e. civil engineers) in LLL activities. The report was produced by a working group (WG) formed under theme F of the Thematic Network "European Civil Engineering Education and Training" (TN EUCEET II). Theme F comprised one single specific project, namely SP.12 "Lifelong Learning in Civil Engineering".

SP.12 is by no means an isolated activity within EUCEET. On the contrary, it looks at the insight of an educational issue closely related to various activities of other working groups of the TN. Table 1.1 shows the most relevant to SP.12 activities completed either as working groups' actions (during EUCEET I) or as specific projects' ones (during EUCEET II).

Following the definitions provided in sub-section 2.3, the work of SP.12 concentrates on the variety of forms of non-formal learning. Some work on continuing professional development of civil engineers has been already done along the activity of WG D of EUCEET I (Manoliu and Bugnariu, 2001). Yet, that work was characterised by a limited rate of response from the members of the TN and, therefore, needed re-examining within the general context of LLL.

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[1] Chairman of WG for SP 12, Aristotle University of Thessaloniki, Greece

Table 1.1 Activities within TN EUCEET with relation to SP.12

Activity	Theme
WG D	Postgraduate Programmes and Continuing Professional Development in Civil Engineering Education
WG E	Balance and Change in Civil Engineering Education
WG F	Demands of the Economic and Professional Environments in Europe with respect to CE Education
SP.4	The Need for Subjects complementing Civil Engineering Technical Studies
SP.5	Problem-oriented, Project-based Education in Civil Engineering
SP.6	Use of ICT in Civil Engineering Education
SP.10	Specialised Knowledge and Abilities of Graduates of Civil Engineering Programmes
SP.11	Academic and Professional Recognition and Mobility of European Civil Engineers

Within the above described framework, the overall aim of SP.12 is to contribute in promoting LLL in Civil Engineering (CE) in Europe, with specific emphasis put on a wider involvement of higher education institutions (HEIs) in it. As put down in the terms of reference before the beginning of the work, the particular objectives of SP.12 focus on:

- reporting on LLL in CE in Europe, especially on the current activities and prospects of all types of LLL providers,
- identifying strategic factors and key processes in successful provisions of LLL, and
- assessing critical factors and proposing actions for a wider involvement of HEIs in LLL.

1.2 Working group members and group history

The WG of SP.12 was formed at the second General Assembly of EUCEET II, which took place in Malta, 6-7 May 2004. The first meeting of the WG took place on Friday 7 May 2004. Twenty-three delegates of the General Assembly representing 17 countries attended the meeting. Prof. Pericles Latinopoulos of Aristotle University of Thessaloniki, Greece had been appointed chairman of the WG of SP.12 by the Management Committee of EUCEET II.

Nine attendants registered during the meeting as active members of the WG, while a few more reserved themselves for a later registration. In fact, there were another three members who confirmed their registration in a short time after the meeting by writing directly to the chair of the WG. After this, the membership of the WG of SP.12 was finalised as shown in Table 1.2.

From the above list Dion Buhagiar and Ivan Totev did not participate actively in the work of SP.12. On the other hand, the following members of the TN contributed to the work by providing input for their countries' national reports or for their associations:

– Eivind Bratteland, Norwegian University of Science and Technology, Norway
– Jan Bujnak, University of Žilina, Slovakia
– José M. Ferreira Lemos, University of Porto, Portugal
– Alois Materna, University of Ostrava, Czech Republic

– Nicos Neocleous, Association of Civil Engineers, Cyprus
– Gulay Ozdemir, Chamber of Civil Engineers, Turkey
– Georges Pilot, Conseil National des Ingénieurs et des Scientifiques de France, France
– Ralph Reinecke, IB-Reinecke – Consultancy for Structural Engineering, Germany
– Xavier Sanchez-Vila, University Polytechnic Catalunya, Spain
– Aarne Jutila, Helsinki University of Technology, Finland
– Doina Verdes, UT Cluj Napoca, Romania

Table 1.2 Members of the working group of SP.12

Surname & Name	Institution	City	Country
Vladimir Andreev	Moscow State University of Civil Engineering	Moscow	Russia
Dion Buhagiar	University of Malta	Valetta	Malta
Laurie Boswell	City University	London	UK
Aniko Csebfalvi	University of Pecs	Pecs	Hungary
Gyorgy Farkas	Budapest University of Technology and Economics	Budapest	Hungary
Manfred Federau	Odense University College of Engineering	Odense	Denmark
Andrej Lapko	Bialystok Technical University	Bialystok	Poland
Pericles Latinopoulos	Aristotle University of Thessaloniki	Thessaloniki	Greece
Bernard Le Tallec	Institut Supérieur du Bâtiment et des Travaux Publics	Marseille	France
Kosta Mladenov	University of Architecture, Civil Engineering & Geodesy	Sofia	Bulgaria
Zdravko Rusev	University of Pardubice	Pardubice	Czech Republic
Ivan Totev	University of Architecture, Civil Engineering & Geodesy	Sofia	Bulgaria

During the 1st meeting of the WG the “Terms of Reference” were discussed and approved for a later presentation to the General Assembly. The General Assembly adopted the proposed ‘Terms of Reference’ for the work of SP.12. The plan of action and the working methods were also discussed during the meeting and approved by the General Assembly.

A second meeting of the WG took place on Friday 22 April 2005 in Thessaloniki, Greece. In the period between these two meetings the following actions were taken:

- A substantial volume of general and specific information - mainly in the form of reports and papers - was collected and distributed among the members of the WG.
- Various templates were formed to assist the collection, classification and reporting of the necessary information, mainly at the national level.
- Each WG member was assigned the mission to report on his own country. Assistance was asked also from elsewhere in order to cover as many European countries as possible.
- The chairman of the WG visited a number of various centers of LLL across Europe

and also attended some international events related to LLL

The above actions are commented more analytically in the following sub-section. During the 2nd meeting the progress of the work done till then was presented and discussed and further decisions were made on how to complete successfully the work before its final presentation to the last General Assembly of EUCEET (Paris, 29-30 September 2005). Emphasis was put on the processing of the varying volume of information that was collected by that time, as well as on some additional actions to enhance the content of the final report.

1.3 Working methods

It was well known from the beginning that reporting on LLL activities in CE would be a very challenging, yet difficult task. As mentioned in the Terms of Reference "in order to acquire the most reliable and complete set of relevant information, all forces of our Thematic Network should be recruited". Real life proved that things could not go better than expected. Thus, at the time of the Thessaloniki meeting a follow-up of the work done so far revealed a number of problems related with the particular task of reporting on LLL activities:

1. The difficulty faced by most WG members to fully complete the national reports. This was due to some reasons, among which the lack of publicly accessible relevant databases.
2. The remarkable lack of interest in replying from people who were asked to help, especially from countries other than the WG members' ones.
3. The very low response rates from associations and other institutions.
4. The varying way of presenting data by the WG members.

To face the above problems the WG decided to provide a short, uniform national report for as many countries as possible and to add to this any other available information.

In summary, the working methods, as adopted to achieve the WG's tasks, were the following:

- Quite many articles, reports, and documents were retrieved in order to assess the current general status of LLL organisation and provision in most European countries, and where possible for CE, in particular. All this material is listed in sub-section 7.1.
- The above mentioned information was used to write up several sections of this report, as outlined in the following sub-section.
- Two templates – one long and one short – were designed to enable the WG members to prepare and submit the national reports for the countries that were assigned to them. Another template was designed and sent out to all associations and other institutions – either members of the TN or not – to collect additional information.
- Additional activities to get specific information, particularly through direct contacts with experts in LLL provision, were considered as highly valuable. Therefore, the chairman of the WG visited 5 specialised centres and attended 2 expert meetings (Table 1.3).

Table 1.3 Visits to centres of LLL and attendance of expert meetings

Date	Place	Centre or event
4 August 2004	Paris	Ponts Formation Edition (Ecole Nationale des Ponts et Chaussées)
3 September 2004	Helsinki	Lifelong Learning Institute Dipoli (Helsinki University of Technology)
31 January 2005	Odense	Centre for Competence Development (Odense University College)
3 February 2005	London	Centre for Professional Development (Imperial College)
4 February 2005	London	Department of Continuing Education (City University)
13-14 February 2004	Brussels	TECHNO TN-2004 Forum (Meeting of experts from EU Thematic Networks)
16-18 December 2004	Tallinn	Annual Seminar of SEFI Working Group on Continuing Engineering Education

One final note concerns the initial thought of the WG to collect, evaluate and disseminate information on ‘examples of good practice’ in the field of LLL in CE. The idea was eventually rejected for two reasons: (a) the difficulty to cover all European countries and the apparent risk of leaving out successful institutions, and (b) the fact that criteria and indicators for assessing the quality of LLL programmes are still under elaboration (European Commission, 2002), and, on the other hand, they should have a transnational dimension in order to be effective (Jallade and Mora, 2001).

Considering all the above, the WG decided to include the whole of its work in a single report, structured in 7 sections. A summary of the contents of the report is next presented.

1.4 Outline of the report

The present report is the single, final and complete output of the work done by the WG of SP.12 of TN EUCEET II on “Lifelong Learning in Civil Engineering”. It consists of 7 individual sections and 1 Annexe, the contents of which are summarised in the following.

In ***Section 1 – Introduction*** the aim and specific objectives of SP.12 are defined. Next, the group’s history and the WG’s members are presented. Finally the working methods adopted and followed throughout all the period of the WG’s operation are analysed.

In ***Section 2 – Lifelong Learning: Concepts and Definitions*** a brief historical overview of LLL is first provided, followed by a list of the most general and important concepts related to LLL. The last sub-section is a glossary of key terms, which more or less appear in the report and, in general, are of some importance when dealing with particular aspects of LLL.

Section 3 – Lifelong Learning in the European Union focuses upon the description of current strategies and implementation methods of LLL in the European Union. This section contains information on legislation issues, policies and decisions of the Union regarding the implementation of LLL in all European countries. The role of Universities in the current and future LLL activities is next discussed separately, due to the widely recognised high value of the involvement of HEIs in LLL policies and implementation. The involvement in specific LLL activities, more or less related to CE, of various organisations and groups is provided in the form of summary data, classified in 3 particular categories and included in the ***Annex A*** of the report.

Specific reference to the scope, structure and implementation of LLL provision in relation to CE is made in ***Section 4 – Lifelong Learning in Civil Engineering***. In this section the purpose of LLL provision and the relevant target groups are discussed first. Next, the main providers of LLL activities are presented, as they relate to these specific groups of learners. The role of the individual categories of the providers as well as the extent and efficiency of their involvement in LLL are also discussed, in relation with the wide spectrum of the different types of LLL provision. In the last sub-section traditional and modern approaches of teaching and learning are presented and commented, particularly within the framework of the current LLL demand and provision characteristics.

Section 5 – National Reports is the part of the report that contains all information collected, processed and classified by WG members and other contributors at a national basis. All data as well as personal comments and views of the reporting people regarding LLL activities in CE for the European countries, in which it was feasible to report upon under SP.12 actions, are synthesized in a uniform manner.

In ***Section 6 – Conclusions*** the main conclusions drawn from the whole exercise of SP.12 are summarised and presented. Based on these and on a conceptualised view of the future paths of LLL policies, some recommendations are provided towards a more effective and wider implementation of LLL activities, especially concerned with CE.

Section 7 – Bibliography comprises two sub-sections. Sub-section 7.1, “References”, is an long list of bibliography on all aspects of LLL, as well as on related issues on engineering. In sub-section 7.2, “Sources for further reading”, a short list of websites of major organisations is given together with an indicative catalogue of scientific journals, in which specialised papers on education and/or engineering issues are more frequently published.

The ***Annex B*** includes all tabulated information related to the contents of Section 5.

2. LIFELONG LEARNING: CONCEPTS AND DEFINITIONS

2.1 Historical overview

From the time it was first conceived, the vision of LLL has been linked with the notion that for any individual person education is continuous and never completed. Such a challenge for learning throughout life goes indeed back to most ancient civilisations, among which the Greeks can claim probably the most famous relevant aphorism phrased by Socrates in the 5th century B.C. “to grow old ever learning”. Today, when LLL seems to be such a complicated and controversial subject, these few words can still be accepted as a universal motto that clearly represents the values of LLL for the learners as well as for the teachers.

Lifelong learning - as an educational strategy – is a concept that emerged through efforts first of the Council of Europe in the 1960s and a little later of OECD and UNESCO, as *éducation permanente, recurrent education* or *adult education*. The central idea was the same in the scopes of all three major organisations: the development of coherent strategies to provide education and training opportunities for all individuals during their entire life.

In practical terms, the interest in materialising in a realistic manner the concepts of lifelong education began in 1972 with the work of a commission headed by Edgar Faure. The outcome of that commission was summarised in the UNESCO's publication "Learning to be". This first official publication on LLL provided a universal and humanistic vision of education, in line with its ideals, and ignited a wide discussion within individual countries and in regional conferences. A few years later, in 1976, the General Conference of UNESCO brought the principle of LLL into the language and repertoire of its activities through the "Recommendations on the Development of Adult Education". These first concise guidelines paved the way towards a future which would treat adult education systematically and widely.

UNESCO went on dealing seriously with LLL in the following years and one generation later, in 1996, gave LLL a sharper profile by the famous report "Learning: The treasure within". This was the outcome of a commission headed by Jacques Delors, which in visionary manner set out among other things the four pillars of learning for adult education: (a) learning to learn, (b) learning to do, (c) learning to live together, and (d) learning to be. The notable report confirmed the humanistic and objective values of education but also highlighted the linkage of LLL with the emerging socio-economic context characterised by globalisation, technology and knowledge-based economies. Of particular interest to our present study is that this report provided also some precepts for universities: "Higher education institutions should be diversified so as to take into account their functions and duties as centres of knowledge, as places of professional training, as the cross-roads for learning throughout life and as partners in international cooperation". In conclusion, UNESCO is considered as one of the major promoters of LLL worldwide and its vision is continually updated through novel and inspired publications (e.g. UNESCO, 1999; 2000).

The other major international organisation, OECD, launched in the early 1970s its "Recurrent Education Strategy", which can be considered as the forerunner of international prescriptions in the field of LLL. In the mid-1990s, the concept of recurrent education gave its place to LLL, a change that was not only semantic, as it implied two important changes vis-à-vis the former recurrent education concept (OECD, 1996). The first issue concerned the introduction of the notion of the *multiple provision* of LLL. Indeed, the new concept of LLL refers to non-formal learning in a variety of settings (at home, at work and in the community), while formal institutions were central to the recurrent education philosophy. The second change characterises the line of provision of LLL and is *individual demand*, rather than *social demand* which was adopted as the driving force of recurrent education. One direct implication of this shift to a *student-centred learning* is reversing the traditional approach of educational provision and adapting curriculum to peoples' abilities, interests and tastes.

As described in more detail in the next section, the European Union came later into the picture, yet in a very vigorous manner. LLL was officially introduced for the first time in the Union's policies in 1995 (European Commission, 1995), reflecting the Commission's new approach to education and training in the light of the major changes taking place in society, particularly the relation between education and employment.

This first phase of the EU's dynamic involvement in establishing the framework for future LLL action was characterised by the adoption of a set of major objectives. These objectives were propagated and tested in a wide range of activities organised in 1996, which was designated by the Council of Ministers and the European Parliament as the "European Year of Lifelong Learning".

The end of the present brief historical overview is marked by the much talked about EU "Memorandum on Lifelong Learning" (European Commission, 2000). Perhaps a continuation and further expansion of what UNESCO had already had in mind, this paper is the cornerstone and also the starting point for the contemporary action of the Union towards its vision of "creating a European area of lifelong learning".

2.2 Concepts

It is well recognised that in today's world things are more complicated than they used to be during the Socrates' era. In other words, there are fundamental problems of definition and terminology in the context of LLL and the related concepts. To overcome this difficulty we decided to confine our discussion herein only to the basic concepts of LLL and provide in the next sub-section a detailed glossary of various terms, which are related either in theoretical or practical way to all issues pertaining to the design and implementation of LLL activities.

From the many stated definitions of LLL we have chosen to present here maybe the most deeply considered one, i.e. that put forward by the European Commission (2001a) after a series of internal discussions and consultation with the Member States. Following this, lifelong learning is stated to be: "All learning activity undertaken throughout life, with the aim of improving knowledge, skills and competences within a personal, civic, social and/or employment-related perspective".

A few extra points need to be said in order to clarify the main issues lying behind the above definition. The so-stated concept of LLL emphasises the central role of the learner, rather than the one of the provider of teaching of the subject, and includes all forms of learning: *formal* (with the learning taking place consciously, e.g. in courses, and with examinations); *non-formal* (from courses but with no examinations); and *informal* (learning which takes place without either courses or examinations) (Osborne and Thomas, 2003). On the other hand, all features of the LLL concept have important implications for key parameters of education and training policies such as: (a) the objectives, (b) the structure of provision, (c) the content, quality and relevance of education and training, (d) the provision of resources and their management, and (e) the roles and responsibilities of different partners and stakeholders.

Among the various subsets of LLL, a term that is most useful when reference is made to LLL provision to specific groups of professionals, like engineers, is that of *continuing education*. A short, still practical definition for it was developed for use by the European Universities Continuing Education Network (EUCEN). This states that it is: "Any form of education, both vocational or general, resumed after an interval following the continuous initial education". Due to the prevailing structure in its provision, i.e. by HEIs, continuing education is indeed a clear subset of LLL: University continuing education is education at a university level for adults, whereas LLL includes education for all ages and at all levels.

In conclusion, LLL is considered nowadays to encompass all learning endeavours over the lifespan and, therefore, it is given a high priority by all major political, economic and social forces in the world. In summary, LLL is used in either one of two ways. In the broad sense it means the social, cultural and economic development of individuals and groups through education and, above all, the learning throughout their lives. In the narrow sense LLL focuses exclusively upon instrumental education, meaning that is seen as the development of a range of specific skills and the training to meet the urgent need for new and varied abilities in the workforce. Within the latter use continuous learning and retraining are considered to be a high priority to ensure economic competitiveness in a world that is marked by increasing technological change and the development of the so-called *knowledge-based society*.

Still, the controversy on LLL definitions emerges even at the moment when, as above, anyone makes a step forward from the single definition of LLL to particular cases. People argue that the broad concept is ambiguous and hides a number of fundamental differences that must be recognised. For example, the provision of learning opportunities should be *education* while the human processes of acquiring knowledge, skills, attitudes and values should be *learning*.

2.3 Definitions and terms

This sub-section serves as a glossary of key terms appearing in this report and/or related to LLL. The compilation is mainly based on a recent publication of CEDEFOP (2004b) – with minor amendments made on a few terms - while some additional definitions are adapted from various publications catalogued in the sub-section 7.1, “References”. The terms are presented not in an alphabetical order but clustered in thematic groups, in order to form comprehensive descriptions of specific issues or concepts.

2.3.1 Knowledge, skills and competences

Knowledge: Definitions of knowledge are legion. Nevertheless, modern conceptions of knowledge rest broadly on several basic distinctions: (a) Aristotle distinguished between theoretical and practical logic. In line with this distinction, modern theoreticians distinguish declarative (theoretical) knowledge from procedural (practical) knowledge. *Declarative knowledge* includes assertions on specific events, facts and empirical generalisations, as well as deeper principles on the nature of reality. *Procedural knowledge* includes heuristics, methods, plans, practices, procedures, routines, strategies, tactics, techniques and tricks; (b) it is possible to differentiate between forms of knowledge which represent different ways of learning about the world. Various attempts have been made to compile such lists, in which the following categories seem to be frequently represented: *objective* (natural/scientific) knowledge, judged on the basis of certainty; *subjective* (literary/aesthetic) knowledge judged on the basis of authenticity; *moral* (human/normative) knowledge judged on the basis of collective acceptance (right/wrong); *religious/divine* knowledge judged by reference to a divine authority (God). This basic understanding of knowledge underpins the questions we ask, the methods we use and the answers we give in our search for knowledge; (c) knowledge encompasses tacit and explicit knowledge. *Tacit knowledge* is knowledge learners possess which influences cognitive processing. However, they may not necessarily express it or be aware of it. *Explicit knowledge* is knowledge a learner can consciously inspect, including tacit knowledge that converts into an explicit form by becoming an 'object of thought'.

Knowledge society/knowledge-based society: A society whose processes and practices are based on the production, distribution and use of knowledge.

Skill: The knowledge and experience needed to perform a specific task or job.

Basic Skills: The skills and competences needed to function in contemporary society, e.g. listening, speaking, reading, writing and mathematics.

New basic skills: New skills that, combined with basic skills, are needed to function in contemporary society. New basic skills are information and communication technology (ICT) skills, foreign languages, technological culture, entrepreneurship and social skills.

Information and communication technology (ICT) skills: The skills needed for efficient use of information and communication technologies (ICT).

Comment: ICT can be further classified as: *Professional ICT skills*: ability to use advanced ICT tools, and/or to develop, repair and create such tools; *Applied ICT skills*: ability to use simple ICT tools in general workplace settings (in non-IT jobs); *Basic ICT skills or 'ICT literacy'*: ability to use ICT for basic tasks and as a tool for learning.

Competence: Proven or demonstrated ability to apply knowledge, know-how and skills in an habitual or changing situation.

2.3.2 Learning (concepts)

Learning: A cumulative process whereby individuals gradually assimilate increasingly complex and abstract entities (concepts, categories, and patterns of behaviour or models) and/or acquire skills and competences.

Learning outcome(s)/learning attainments: The set of knowledge, skills and/or competences an individual acquired and/or is able to demonstrate after completion of a learning process.

Valuing learning: The process of promoting/recognising participation in and outcomes of learning, to raise awareness of its intrinsic worth and to reward learning.

Lifelong learning: All learning activity undertaken throughout life, with the aim of improving knowledge, skills and competences and/or qualifications within a personal, civic, social and/or employment-related perspective.

Comment: In parallel to the term *lifelong learning*, which draws attention to time, the newly-coined term *lifewide learning* draws attention to the spread of learning. Hence, it brings into focus the complementarity of formal, non-formal and informal learning.

Lifewide learning: Learning, either formal, non formal or informal, that takes place across the full range of life activities (personal, social and professional), and at any stage of our life.

Comment: lifewide learning is a dimension of lifelong learning.

Formal learning: Learning that occurs in an organised and structured context (in an education/training institution or centre) and is explicitly designated as learning (in terms of objectives, learning time or learning support). Formal learning typically consists of three 'steps': primary education, secondary education and tertiary education, and leads to certification. It is intentional from the learner's point of view.

Non-formal learning: Learning that takes place alongside the mainstream systems of education and training. It is embedded in planned activities not explicitly designated as learning (in terms of objectives, time or learning support), but contains an important learning element. Non-formal learning is intentional from the learner's point of view. It typically does not lead to certification.

Comment: Non-formal learning comprises various forms: vocational educational and training (for technicians); continuing education and training; continuing professional development and individual learning programs; and adult education. Apart from formal education institutions, it may be provided in the workplace and through the activities of civil society organisations and groups.

Informal learning: Learning resulting from daily work-related, family or leisure activities. It is not organised or structured (in terms of objectives, time or learning support) and it is not necessarily intentional from the learner's perspective. In this way informal learning may well not be recognised even by individuals themselves as contributing to their knowledge and skills.

Comment: informal learning is also referred to as experiential or incidental/random learning.

2.3.3 Learning (types)

Prior learning: The knowledge, know-how and /or competences acquired through previously unrecognised training or experience.

Compensatory learning: Learning intended to fill the gaps accumulated by individuals during compulsory education, mainly to enable them to take part in training.

Open learning: Learning in which learners can acquire knowledge, know-how and/or skills and competences in their own time and (within specified limits) at their own pace.

Learning-by-doing: Learning acquired by repeated practice of a task, but without instruction.

Learning-by-using: Learning acquired by repeated use of tools or facilities, but without instruction.

2.3.4 Education and training (provision)

Pathway of training: Broad group of training programmes that share the same main characteristics (e.g. duration, place of training, qualification level, etc.). Most countries have different vocational training pathways. The main difference is school- or training centre-based versus work-based training.

Vocational education and training: Education and training which aims to equip people with skills and competences that can be used in the labour market.

Initial (vocational) education and training: Either general or vocational education carried out in the initial education system, in principle before entering working life.

Comment: (a) some training undertaken after entry into working life may be considered as initial training (e.g. retraining); (b) initial education and training can be carried out at any level in general or vocational education (full-time school-based or alternance training) pathways or apprenticeship.

Further training: Short-term targeted training typically provided following initial vocational training, and aimed at supplementing, improving or updating knowledge, skills and/or competences acquired during previous training.

Continuing (vocational) education and training: Education or training after initial education or entry into working life, aimed at helping individuals to: (a) improve or update their knowledge and/or competences; (b) acquire new competences in the perspective of a career move or retraining; (c) continue their personal or professional development.

Comment: continuing education and training is part of lifelong learning and may encompass any kind of education (general, specialised or vocational, formal or non formal, etc.). It is a key feature for the employability of individuals.

Off-the-job-training: Vocational training undertaken away from the normal work situation. It is usually only part of a whole training programme, in which it is combined with on-the-job training.

On-the-job-training: Vocational training given in the normal work situation. It may constitute the whole training or be combined with off-the-job training.

Retraining: Training enabling individuals to access either an occupation requiring skills other than those for which they were prepared originally, or new professional activities.

Adult education: Education provided for adults, often intended for general purposes rather than vocational education.

Comment: adult education is close to, but not synonymous with, continuing vocational education and training. It is usually used: (a) to provide general education for adults in topics of particular interest to them (e.g. in open universities); (b) to provide compensatory learning in basic skills which individuals may not have acquired in their initial education (such as literacy, numeracy); (c) to enable people to access and attain qualifications not gained, for various reasons, in the initial education and training system or to acquire, improve or update skills and/or competences in a specific field (this is continuing vocational education and training).

2.3.5 Education and training (methodologies)

Continuing Professional Development: The systematic maintenance, improvement and broadening of knowledge, experience and skills, and the development of personal qualities necessary for the execution of professional and technical duties throughout one’s professional life.

Comment: The basis of continuing professional development is learning that comes about in different ways and can be formal, non-formal and informal. It encompasses technical and non-technical matters.

Work-based learning: A methodology that can be adapted to address at pre-university, undergraduate and postgraduate university, and continuing professional development stages of education. This descriptive term can refer to any of the following: (a) learning (in general) that can be gained within a work context; (b) structured or planned methods or programmes (such as Action Learning) for the training and development of employees in the workplace; (c) learning activity that takes place ‘on-the-job’ rather than within formal contexts such as training courses; (d) accredited educational offerings delivered on-site or in-house.

2.3.6 Assessment of knowledge, skills and competences

Validation of informal/non-formal learning: The process of assessing and recognising a wide range of knowledge, know-how, skills and competences which people develop throughout their lives in different contexts, for example through education, work and leisure activities.

Qualification: (a) The requirements for an individual to enter, or progress within an occupation; and/or (b) an official record (certificate, diploma) of achievement which recognises successful completion of education or training, or satisfactory performance in a test or examination.

Recognition (of competences): (a) *Formal recognition*: the process of granting official status to competences, either through the award of certificates or through the grant of equivalence, credit units, validation of gained competences; and/or (b) *social recognition*: through acknowledgement of the value of competences by economic and social stakeholders.

Certification (of competences): The process of formally validating knowledge, know-how and/or competences acquired by an individual, following a standard assessment procedure. Certificates or diplomas are official documents, issued by accredited awarding bodies.

3. LIFELONG LEARNING IN THE EUROPEAN UNION

3.1 Strategies and implementation

In the European Union the challenges which demand a new approach to education and training (i.e. the basic operational forms of LLL) include: the scale of current economic and social change, the increased pace of technological change, the ever transforming nature of work and the labour market, the rapid transition to a knowledge-based society, and the demographic pressures resulting from an ageing population in the continent. As a response to these concerns of the Union, the rationale for LLL is associated with the consequent demands of such a society that requires individuals to gain new skills and update existing ones.

Although the European Union's policies and actions regarding LLL span over a much broader spectrum of concepts, strategies and implementation methods than the ones discussed herein, a brief overview of the European approach is quite necessary. This is because this approach constitutes the wider framework within which all relevant separate actions and policies can be classified and evaluated.

The European Union's active promotion of LLL began in earnest in the mid-1990s, first with the publication of the White Paper on "Teaching and Learning" (European Commission, 1995) and next by officially establishing 1996 as the "European Year of Lifelong Learning". In operational terms it was then when the Community's programmes SOCRATES, LEONARDO DA VINCI and YOUTH shared the same preamble and were placed under a common umbrella of promoting LLL. In strategic terms, the Lisbon European Council in March 2000 set the goal for the European Union to become the most dynamic and competitive knowledge-based society in the world. To this end the European Commission published the "Memorandum on Lifelong Learning" (European Commission, 2000), a staff working paper which invited responses.

The Memorandum became the subject of a major pan-European consultation process. In the discussion took part more than 12,000 people across the Member States, the EEA and the candidate countries. The overall aims of the European Union expressed in the Memorandum were "promoting active citizenship; and promoting employability". A year later, and based on the consultation's conclusions, the Commission presented a

Communication, i.e. a detailed policy document (European Commission, 2001a), which led to the adoption of a Council Resolution on lifelong learning (Council of the European Union, 2002).

The response of the European citizens and the member states to all above has been positive (CEDEFOP, 2002a; CEDEFOP & European Commission, 2003; European Commission, 2001b; 2001c; 2003a). Still, the implementation process varies among individual member-states, particularly as far as the incorporation of the proposed policies and actions within national practices is concerned. Various studies (Eurydice and CEDEFOP, 2001; CEDEFFOP, 2002b; CEDEFOP, 2004a) show that in general little real progress has been made, even since the large-scale consultation process that was launched following the publication of the Commission’s Memorandum. In conclusion, “it is clear that all countries in Europe have to take some action to make lifelong learning a concrete reality, but that most countries must act decisively and rapidly if they are to stand any chance of doing so at a level that would begin to satisfy the goals espoused by Education and Training 2010” (CEDEFOP, 2004a).

Some more recent developments at European level include:

- In March 2003 the Commission set up PLOTEUS, an internet Portal on Learning Opportunities throughout Europe.
- In April 2003 the R3L initiative was launched, linking 120 learning regions with a view to exchanging know-how and developing methods of promoting LLL at regional level (European Commission, 2003c).
- Several networks and projects dealing with LLL issues were supported financially under various European education and training programmes. Among them these, which are more or less related to our theme’s discussion, are presented in sub-section 3.3.
- In early 2004 the first joint interim report from the European Council and the European Commission on progress towards the Lisbon goals for education and training was adopted (European Council and European Commission, 2004). In this it is stated that LLL – the guiding principle of education and training policies – should be given a prominent place and that there is open acknowledgement that deficits in this area need concerted attention.
- Finally, on July 2004, the Commission proposed a Decision of the European Parliament and the Council to establish an integrated action programme in the field of LLL. This integrated programme for education and training, proposed for implementation in the period 2007-2013, will comprise four specific programmes: COMENIUS, ERASMUS, LEONARDO DA VINCI and GRUNDTVIG (European Commission, 2004).

3.2 The role of universities

Recent comparative studies on university continuing education in European countries (Mitchell, 2000; Kokosolakis and Kogan, 2001; European University Association, 2003; Osborne and Thomas, 2003, Osborne et al., 2004) show that universities - although considered as major providers - have in average only a limited role in the post-degree development of professionals. However, behind the European averages, one can detect convergences and divergences between individual countries but also between universities alone. The UK, Iceland, France, the Czech Republic, Slovakia and Romania have the highest percentages of universities involvement in LLL strategies in general (European University Association, 2003). The Nordic countries also have a long tradition and show an increasing rate in the development of relevant activities. A very comprehensive study on the involvement at the national level of European HEIs in continuing education – the very specific form of LLL provision by universities – has been published by NIACE and is the product of collective work by the Network THENUCE (Osborne and Thomas, 2003).

In broad terms, universities approaches taken to LLL can be categorised into three basic types: (a) LLL is separate and seen as *marginal* to the main business of the university; (b) LLL is regarded as one of the 3 equal *pillars* of university’s activity along with research and formal education; (c) LLL is seen as the *basic concept* of the university. Evidence shows that many, especially older and more distinguished, European universities might fall in the first category, fewer in number, but entering dynamically in the field, belong in the second one, and much less, often lacking relative prestige, can be classified under the third one.

Regarding the structures that have emerged thus far to facilitate the development of LLL in higher education, most existing surveys show that almost in none European country LLL is fully integrated into the higher education system. An important structural element for LLL in several countries seems to be the Open University, a higher education institutional model that varies as far as degree awarding power, admission regulations and teaching and learning methods are concerned.

Continuing professional development or continuing education is the predominant approach for LLL provision by universities, organised quite successfully mainly through relevant departments or centres. In many cases the provision of LLL or continuing education is organised and delivered separately from the mainstream activities of the institution. In addition, when the provision is at graduate level and beyond, an increased amount of LLL is delivered via open and distance learning by making use of new technologies. In all cases the main advantage in university continuing education is that one can make use of the central facilities (lecture halls, laboratories, libraries, information technology infrastructure etc.).

The centres or departments, i.e. the units of university-based provision of continuing education, differ as far as the issues of their organisation and management are concerned (Montesinos and Romero, 2003). However, there are several common elements which prove that this structure is a *good practise* one for continuing education activities. In fact, these centers are able to cooperate efficiently with the industry and the business world on several educational or professional issues, to establish cooperation agreements with other LLL providers, and to promote international cooperation in teaching and training (Soeiro, 2001).

As stated above, even in the best cases, the percentage of HEIs involvement in continuing education is low and rarely exceeds 10% of the total provision, the remaining being made both locally by employers and private training companies and globally by professional associations and other public or private organisations. Moreover, despite the fact that their continuing education has often been subsidised, European universities have been relatively unsuccessful in competing with the private providers (Osborne and Thomas, 2003).

The main reasons that slow down or even prevent universities to integrate continuing educational programmes into their system are:

- Institutional opposition mainly dictated by differing traditions regarding the university’s strategic priorities, like orientation to mainstream undergraduate and postgraduate teaching and/or research.

- Academic staff resistance driven by the preference to more useful for their careers' advancement activities, like research.
- Lack of clear incentives (especially monetary).
- A necessary implementation of structural and cultural changes at the institutional level.
- National or European policies targeting on other strategic priorities (e.g. employment strategies and social agenda).

On the other hand, such a negative position is very much against the interest of the universities and by no means serves the vision of the European Union on their role in the "Europe of Knowledge" (European Commission, 2003b). The following list of additional benefits, if universities were much more active in the provision of continuing education, is indisputable, as it has proven to be the reality for those institutions with a successful background in these activities (Becher, 1993; Osborne and Thomas, 2003).

1. Creating close and regular links between the academic staff and practising members of relevant professions.
2. Attracting funds for research or development work, as a side impact of the above.
3. Updating knowledge for the specific LLL subject and at the same time updating the teaching to full-time students to reflect the current attitudes of their profession.
4. Expanding the proper field of teachers by penetrating easily to other disciplines, like those demanded by LLL potential learners.
5. Getting a more significant role to play in the regional economic and social development and meeting the moral obligation to make available state-of-the-art knowledge to all parts of society.

However, the *market* is more than ever seeking for LLL *products* and, if these are not provided by universities, the other *competitors* would surely benefit instead. In fact this is what happens already in several European countries, where the field of LLL provision is monopolised by other agencies. In order to make a LLL policy work, especially involving the higher education institutions, we can summarise here what is required by both sides, i.e. the learners and the educators. What is normally sought by the learners' side includes:

1. Adequate offers (i.e. learning opportunities for the diversity of potential learners).
2. Motivation (learners have to be convinced that taking up learning offers is both possible and worthwhile).
3. Recognition and accreditation (of knowledge, competencies and skills).
4. Appropriate financial and labour conditions (financial assistance and flexibility at work).

On the other hand, universities, as *mainstream* LLL providers, should:

1. Reconsider their approach and relationship to LLL and integrate it into their overall strategy and mission.
2. Adopt internal policies to promote the recognition of all types of LLL that they offer.
3. Develop mechanisms capable of assuring a continuous and adequate financing of these activities.
4. Facilitate access to learning opportunities.
5. Provide well defined and designed programmes.
6. Make the whole process attractive to their teaching staff, mainly by balancing all

teaching duties (typical and LLL) and offering additional career advancement rewards.

7. Above all, make LLL a distinct and distinguished characteristic of their institution as well as a component that will add extra value to its overall pursuit of *excellence*.

3.3 Associations, networks and projects

In the Annex A, a selection of some associations, networks and projects is presented. Every one of these has a close relation with LLL, CE education or higher education institutions actions and policies. The degree of connection with these three issues varies, but every body listed in the following paragraphs is involved at least in two of them.

Most of the *associations* appearing in the Annex A are autonomous bodies, some of them with a rather long history, serving numerous members from the professional or academic areas (individuals and/or institutions). As such they have their own policies, which in general may have some connection with European Union policies in the respective fields of action. Moreover, and as their titles show, these associations are mostly engineering ones, covering a wide spectrum of formal and non-formal learning types.

On the other hand, the *networks* and *projects* (listed in 3.3.3), which complete the presented collection in the Annex A, are based on diverse groups of partners, in principle from European countries, whose common task is to study and promote issues of education and training, mainly in engineering fields. For almost all groups from these two categories the connection with European Union policies is very strong, as their functions are being or have been wholly or partly funded under various European education and training programmes.

More detailed information about the whole range of activities of all the bodies referred in the present sub-section can be obtained by browsing their websites. The information appearing below was retrieved from the relevant websites accessed in February 2005. It follows that websites addresses as well as the appropriate information are accurate and updated as to that particular time period.

4. LIFELONG LEARNING IN CIVIL ENGINEERING

4.1 Purpose and target groups

Before analysing the purpose of providing LLL to people involved in CE, it is useful to list an outline of the main attributes of the civil engineer of the 21st century in order to fulfil his responsibilities towards the built and natural environment and to gain professional and social recognition (da Fonseca, 2001). A characteristic document describing these attributes is the “Code of Professional Conduct for European Civil Engineers” adopted by the European Council of Civil Engineers (ECCE) in 2000. The Preamble of the Code states that:

- The purpose of civil engineering is to improve living conditions for humanity, always safeguarding life, health and property.
- A civil engineer is a servant of society and a promoter of culture and quality of life.
- A civil engineer must survey and analyse the demands of the present and anticipate

future developments.

Civil engineers are university degree-holders, their discipline being notably of a high technological character. This means that in relation to their professional career formal learning is well formulated and structured, still always depending on current local and global needs (Jones, 2003b). On the other hand, informal learning is an individual's matter and, thus, it can hardly relate to any particular professional attribute. Hence, the current interest of LLL activities of civil engineers rests in the non-formal type of learning, and this is the issue that is examined in detail in this section and in the broad framework in the whole report.

Among the various forms of learning that are normally classified as non-formal ones, the one that is of primary interest to civil engineers is *continuing education*. As defined in 2.3.4, this refers to education or training after initial education or entry into working life, aimed at helping individuals to: (a) improve or update their knowledge and/or competences, (b) acquire new competences in the perspective of a career move or retraining, and (c) continue their personal or professional development. The last is in fact the key approach to all professionals seeking the full spectrum of lifewide learning options, as it can easily be conceived by its most accepted definition: "*Continuing professional development* is the systematic maintenance, improvement and broadening of knowledge, experience and skills, and the development of personal qualities necessary for the execution of professional and technical duties throughout one's professional life". For CE in particular, continuing professional development is a methodology that has been encouraged by the profession - and in many cases by professional engineering institutions - as a means to maintain and enhance engineering skills of the whole workforce of this particular field.

LLL in CE is becoming a vital activity worldwide, and, according to many, a commercial issue, due to the inevitable competition among its providers (Legait and Frank, 2001). It is also a dynamic process, as new building techniques, design technologies and materials are the order of the day. Finally, it is more than a necessity due to the current enlargement of the profession's content and culture as: (a) traditional professional engagements have to be integrated within critical issues, like urban development and environmental protection, (b) changes taken place in the construction industry introduced new forms of contracts, ways of managing projects, environmental and planning legislation, and health and safety regulations, and (c) information technology has been already established as a powerful tool in a civil engineer's everyday training and practice.

The prevailing contemporary view, regarding the educational pathway of a civil engineer, is that a major emphasis should be given to an initial broader training, followed by LLL to enable him to update and learn effectively and efficiently, according to his personal and/or professional needs. This is not a European view only; it is indeed the core issue in every developed society. In the very significant text "Civil Engineering Body of Knowledge for the 21st Century" (ASCE, 2004) it is stated that: "Civil engineers are expected to simultaneously possess broader capability and greater specialised technical competence than was required of previous generations". Consequently, LLL, and more particularly, continuing professional development for an individual civil engineer should aim at:

- Acquiring current knowledge, skills and professional experience.
- Fulfilling personal career aspirations, both in the short and long term.
- Meeting successfully the employer's business objectives and opportunities.

- Above all, keeping himself posted about the continuous changes in industry, technology, society and the profession.

Formal (university) education admittedly suffers, at least for now, in that the teaching of technical subjects quite often fails to prepare the graduates to face all the problems encountered in practice as well as to allow them to develop self-sufficient learning skills. Particularly the second one is a distinct drawback, taking into account not only the rapid obsolescence of knowledge but also the uncomfortable fact that there is an increasing gap between the rate of learning and the rate of forgetting. This issue becomes more acute for graduates from traditional universities with heavy curriculum content, a practice based on the erroneous belief that the Diploma symbolises the end of the educational process. However, for almost every active engineer skills, competence and know-how needs are complementary to knowledge and understanding ones. As the latter are the major tasks in the agenda of higher education institutions, while the former are rarely given a priority, if any at all, it is in the arena of LLL where these qualifications should be sought altogether.

The interest in the pursuit of LLL in CE comes from many sources: individuals, private companies, the construction industry, governmental bodies, professional organisations and trade unions. The last group brings into focus another dimension of the LLL issue, apart from the one discussed herein, which is indeed the continuing professional development of university-educated civil engineers. This other dimension relates to the vocational education and/or training of other professionals, technicians or workers, who are also involved within the whole range of activities of the CE industry. Consequently, the target groups of LLL provision in CE-related subjects should generally comprise:

1. Professional *theoretical* engineering degree holders (i.e. university graduates).
2. Professional *applied* engineering degree holders (i.e. the graduates from institutions like the Fachhochschule in Germany, the Hogeschole in the Netherlands, the Technological Education Institutes in Greece etc.).
3. Engineering *trained* technicians (i.e. all those having a basic knowledge of engineering principles and vital technical skills, mainly obtained through an initial short-term education at various types of technician schools).
4. Workers, who are initially non-educated or even non-skilled individuals and who are employed - or tend to be - in the construction business.

As shown thus far, the issues discussed in this report relate to the first two categories of the above mentioned human potential involved in CE, mainly because universities can be the essential source for their LLL provision. However, the other two groups are of no less importance as far as their LLL content and prospects are concerned. Today there are approaches, like *workplace learning* (commented in 4.4.2 below), that enable those who have not traditionally attended further or higher education, like technicians and workers, to exit in and out of LLL (Chisholm and Burns, 1999). Yet, relevant policies and implementation actions fall within the more general issue of adult learning, for which a broader, mostly political, involvement of all societal stakeholders is necessary (Libert, 2004).

4.2 Main providers

The number of continuing CE education providers in the whole Europe is large. Their identification and, moreover, their classification is not an easy task on its own, even at the national level. This is because the professional associations, private companies and universities, which supply such educational services, vary in organisational structure and management, institutional attitudes, learning/teaching methods, financing forms, human potential and technical infrastructure, and type and size of activities. As a consequence, and despite the efforts of some of the associations, networks and projects listed in the Annex A, preparing a complete inventory of European providers of LLL, even in all fields of engineering, seems to be an unattainable task, at least for the present.

However, a lot of progress is currently ongoing, from which we have to acknowledge the very interesting contribution of the relevant group of the Thematic Network E4 on the taxonomy and typology of continuing engineering education suppliers in Europe (Montesinos and Romero, 2003). Dedicated to the university-based provision, this specific report is a valuable reference and a guide, particularly in the issue of institutional management. On the other hand, the present work by the WG of EUCEET's SP.12 aims, among others, to the same direction, i.e. to identify and classify as many as possible of the main providers of LLL in CE in various European countries. This is presented in Section 5.

One of the most interesting exercises of the activity on "Engineering Professional Development for Europe" of E4 resulted in a "Recommendations Resume" regarding the management of university-based continuing engineering education activities (Montesinos and Romero, 2003). The summary of this study is reproduced in Table 4.1.

Table 4.1 Recommendations resume (after Montesinos and Romero, 2003)

Value Chain step. For …	Recommendations
Demand Analysis	▪ Understanding business processes and strategy of your customers ▪ Get to know your customers ▪ Knowledge of technical trends ▪ What the competitors do not deliver ▪ Identify competences to be developed
Product Design	▪ Precisely identify the competence needs of the client ▪ Choose an adequate price ▪ Define right content for courses ▪ Staff competences in the continuing engineering education centre
Marketing	▪ Know the market ▪ Obtain a good quality in the content of the course ▪ Increase society-university interaction ▪ Networking and co-operating with other providers
Sharing Open and Distance Learning (ODL) Materials	▪ Adaptation of the materials (linguistic and cultural aspects) ▪ Define a clear protocol /contract ▪ Modular design and top-down design ▪ Create a map of institutions you can collaborate with, and contact them ▪ Give clear instructions to students about how to follow the course ▪ In all the ODL course, the human interaction is quite important

4.3 Types of provision

For the continuing education delivered by universities and other providers, the whole ensemble of programmes includes: (a) full-time and part-time programmes for older adults leading to qualifications, (b) courses taken for vocational reasons or for love of the subject, (c) some courses leading to credits, diplomas and degrees, others not, and (d) courses often taken by graduates but not always so (Osborne and Thomas, 2003)

Particularly for CE, the programmes of continuing professional development or continuing education have to be developed bearing in mind the individual needs of the four key stakeholders: civil engineers, employers, government, and professional associations. Currently, the prevailing types of such a provision can be classified as:

1. Short courses, usually of 1-3 days and not more than 5 days of duration.
2. Longer training courses, spanning a learning period of a few weeks to some months.
3. Non-degree postgraduate courses, usually of a long duration, such as an annual one (these are based on short-time lecturing/coursework sessions, mainly during specific week-days or, preferably, week-ends).
4. Formal postgraduate academic studies, full-time or part-time, leading to an official degree of specialisation.
5. Other types of professionally-oriented or company-driven activities, such as attending specific conferences, seminars, lectures and workshops.

Usually, all these types of provision are offered by the providers at their own premises, but, with the exception of type number 4, in a way that allows learners to stay in a full time employment in their private companies or public services. On the other hand, a rapidly emerging alternative approach of LLL is the work-based one, by which, not only the employment status remains undisturbed, but also additional benefits are gained, as presented in the next sub-section.

Several issues are quite important, as related to all types of provision. Among them, access and participation, investment in and financing these activities, educational standards, systems and needs, accreditation of courses and providers, qualification systems, recording professional achievement, and strategic partnerships between providers and industry are the prevailing ones. A comprehensive study on engineering continuing education, which was indeed the basic starting reference for the E4 study previously mentioned, is the position paper “A Call to Action” produced by the TN H3E (Radfield and Schaufelberger, 1998).

4.4 Teaching and learning methods

4.4.1 Traditional versus modern approaches

One of the most exciting and challenging issues along the provision of LLL to civil engineers is the design and implementation of teaching and learning methods. Above all rests the change in pedagogical methods that is due to the rapid development of communication and information technologies (CIT) (Osborne and Oberski, 2004). Today, audio, video and computer technologies are more common delivery modes. Even published books include CD-ROMs storing valuable complementary information and/or software for specialised applications, as well as links to websites for the updating of reference documents and other useful elements. The Internet itself is a most valuable source for almost everything, provided that a method of efficient and effective browsing is used (this is indeed a subject of its own for *teaching/learning how to learn*).

In its contemporary form *distance learning* is also becoming a model for the teaching/learning process, either alone or mixed with more traditional methods. The increasing universality of both e-mail and the Internet are changing the situation significantly. Distance learning evolves as a very promising source of learning in continuing education because the flexibility and control that offers to the adult reader is highly attractive to him: learning is available as and when time is available, allowing thus the learner to work on his own pace and also repeat sections or whole courses at his wish. This form of LLL provision highlights the shift from teaching to learning, that is increasingly adopted in many European countries, and that implies more independent learning. Independent learning is indeed not only a feature of distance learning but also of self-learning and negotiated curricula (Askling et al., 2001).

On the other hand, *traditional methods* used in courses, like conventional lectures, laboratory classes, workshops and seminars will continue to be important, as they provide the advantage of an in-person interaction between tutor and student. Therefore, it seems to be the rule rather than the exception that many reputable centres of LLL provision, especially the university-based ones, still opt for the lecture as a mature and established technique that can be given to a large number of students simultaneously while at the same time allows for a face-to-face contact. Moreover, traditional teaching is much enhanced now by improved support materials and techniques through the use of photocopying, computer-generated material, projection from PCs and Internet–accessed materials (Jones, 2003a).

However, our days or not characterised only by the shift *from teaching to learning* but also by the shift *from supply-led to demand-led LLL*. This shift entails more than just taking the needs of individual learners into account, i.e. under the previously mentioned *student-centredness* of modern LLL philosophy. Cooperation among all stakeholders (learners, employers, regional authorities, labour market and centres of provision) is also necessary in order to design offers that meet actual demands. Within such a framework and mainly in the case where continuous professional development is a company's task, one can classify the types of teaching and learning into two broad types: university-oriented or company oriented methods (Fink, 2002).

From the earliest days of the first universities, the prevailing model has been that of study on campus where the university controls and decides the style of teaching and the context of learning. Within this sense, *university-oriented* methods are nowadays structured as ready-made courses within given subject areas that are offered to both the individual company as onsite courses or to groups of companies with individual enrolments. On the other hand, in recent years it is recognised that the university is no longer the only environment in which education is designed and delivered. Practical evidence for this are the *company-oriented* methods, which include various types of courses of the traditional or distance-education forms, and above all the work-based and workplace learning forms. These alternative models of off-campus learning, which can be implemented at both undergraduate and postgraduate levels, are becoming popular in several European countries (Chisholm and Burns, 1999; Fink, 2002). This is why special reference is made to them in 4.4.2 below.

In conclusion, both general teaching and learning approaches, i.e. modern and traditional, as applied for continuing education purposes, are real challenges not only to the learner but also to the educator. Still, the specific demand for educational support from lifelong learners is labour intensive for educators within their new teaching duties. Because of the varying natures of courses the necessary coursework differs: educational material, tutorials (problem-solving, project-supervision), workshops, laboratories etc. Whether all these generate a motivation or not is a question that can not be answered but by every teacher himself.

The TN EUCEET has early recognised the importance of these issues, especially in relation to a scientific field like CE, where changes in the curriculum are the order of the day. To this end several specific projects have dealt at various degrees with similar subjects.

4.4.2 Work-based and workplace learning

In simple words the term *work-based learning* is understood to refer to a process whereby activity carried out in the workplace can result in learning. Following a more analytic definition (given in sub-section 2.3) “work-based learning is a methodology that can be adapted to address at pre-university, undergraduate and postgraduate university and continuing professional development stages of education”. This descriptive term can refer to any of the following:

- Learning (in general) that can be gained within a work context.
- Structured or planned methods or programmes (such as action learning) for the training and development of employees in the workplace.
- Learning activity that takes place *on-the-job* rather than within formal contexts, such as training courses.
- Accredited educational offerings delivered on-site or in-house.

The main idea of work-based learning as a tool for professional development is to create a *learning process* that has the following characteristics (Fink, 2002):

- Is integrated in the job task.
- Does not require absence from work or family.
- Ensures professional relevance.
- Is integrated in the organisation.
- Is adapted to the individual concerning the context, extension and speed.

Workplace learning is a suitable LLL approach to unskilled workers hesitating to participate in formal or on-campus education programmes, while work-based learning is a broader methodology, allowing for an efficient participation of all engineering staff of a company in more flexible and mixed types of programmes of study.

Usually a work-based programme of study is shaped by an interaction of the employee (i.e. the potential learner), the employer and the institution that is delivering the programme. Under such a development, a work-base programme of study will ultimately involve partners who recognise each other’s statuses, needs and expectations. There are various models of this type of learning that can be developed: learning agreement, learning contract or learning programme (Chisholm and Burns, 1999; Burns and Chisholm, 2003).

By these models, academic supervisors, such as university professors, become facilitators in terms of the development of the learning contract process that has the above characteristics, while at the same time are set to a new task: to transform *identified competence deficiencies* into *specific learning goals*. When any such deficiencies are identified among individuals or a group of engineering staff, a plan of competence transfer is negotiated between the engineers, their manager and the delivering institution and a contract is shaped defining the following elements: (a) learning goals, (b) learning/pedagogical means, (c) milestones/tasks for the student/practicing engineer, (d) success criteria, (e) involvement from the company, and (f) involvement of the delivering institution/centre (Fink, 2002).

The most known and experienced centres delivering various programmes of work-based learning in engineering in Europe are the “Scottish Centre for Work-Based Learning” based at Glasgow Caledonian University (Glasgow, UK) and the “ELITE” Centre at Aalborg University (Aalborg, Denmark).

5. NATIONAL REPORTS

5.1 Information collected and way of presentation

This section includes collected information on the current status of LLL implementation in CE in various European countries. This collection was one of the primary goals of EUCEET’s WG of SP.12 and therefore it was the main line of activation of the WG’s members. The first target in the relevant reporting was the country of each WG member. Other members of the TN kindly undertook the mission to report on their countries. In sub-section 1.2 all contributors’ names are listed. In the following sub-section the outcome of this teamwork is presented for a total of 18 countries (see Fig. 5.1 for a diagrammatic coverage of Europe).

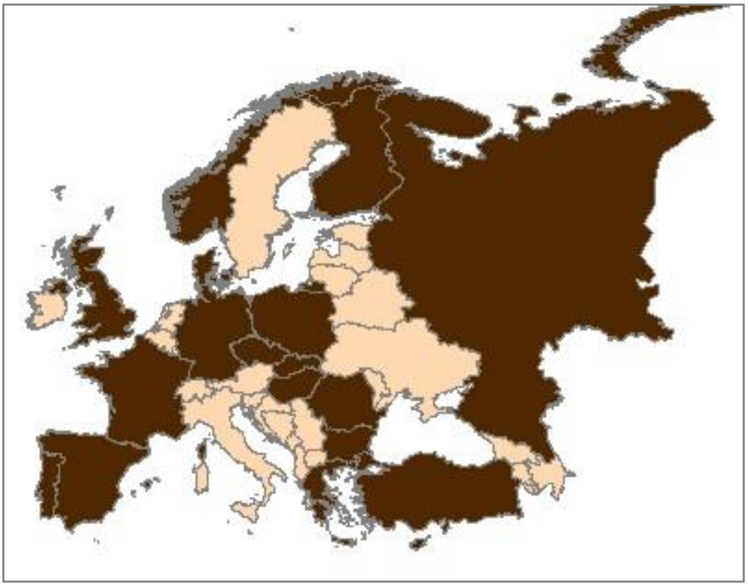

Figure 5.1 The countries covered by the survey (shown in darker shade)

As mentioned in sub-section 1.3, the initial task of presenting a full picture of the LLL in CE status throughout all European countries has early been proved as an infeasible one. For various reasons explained in that section some European countries are missing while on the other hand the information on the present ones is not equally complete for all. This is mainly due to the fact that the work done in EUCEET is pure voluntary and due to the lack of specific funding the retrieval of information and relevant data was made only on a personal basis.

Nevertheless, the content of this chapter is more or less original in the sense that it focuses on a specific discipline, namely CE, and in no way the information presented can be found elsewhere in such a compact form. Basically it is a useful knowledge base and a starting point for a fruitful discussion on the subject.

The content of this section is complemented by a series of tables included in the Annexe B. The data in these tables appears in a simple reference form which includes the titles of the institutions that provide any form of LLL programmes as well as their websites. Note that in most cases it is the web address of the parent institution, and not the one of the specific LLL unit within it, that is provided. Again, these lists are not complete and even non-existent for some countries. This does not mean at all that the activity in the countries is proportional to the number of the lines appearing in the corresponding tables. On the contrary, at least for some countries (like Germany and UK), the complete lack of information is due to the very large number of LLL providers and the inherent difficulty to even spot among them the most prominent ones.

5.2 Reports of the individual countries

5.2.1 Bulgaria

The demand for participation in LLL by civil engineers in the country is medium. This is because the need of continuously improving one’s professional skills hasn’t been fully realised yet. On the other hand, specialists from relatively older generations, who have mostly suffered from the transition from state-governed to market economy and are expected to look for re-qualification, are not keen on working with computers. For this reason their LLL-participating ratio is almost negligibly small. In fact the interest in participating in LLL of civil engineers for various age groups is: 65% for the 25-34 years group, 30% for the 35-44 years group, and 5% for older ones. From all those 40% are males and 60% are females.

Based on data for the 2000-2004 period, it appears that 93% of the subject’s learners are civil engineers, of whom 27% private employees, 15% public employees, 16% new graduates, 5% unemployed, 30% students, while the rest 7% are other professionals (electrical, mechanical, forestry, woodworking/furniture, mining engineers, mathematicians, economists, and jurists).

The types of main providers of LLL in CE in the country are: (a) The Bulgarian Scientific and Technical Union of Civil Engineering (NTSSB) - 10%, and (b) 2 universities and 1 higher institute - 90%. The reason why LLL provision is shared in this way is that at present well supplied laboratories, staffs, as well as units capable to respond to the demand of LLL in CE are available in the educational institutions only. Moreover, professors from these institutions constitute the core part of the lecturers in the relevant activities of NTSSB.

The most successful provider of LLL in the country is the University of Architecture, Civil Engineering and Geodesy in Sofia, which has a special and independent unit of the faculty rank called Centre for Open and Continuing Education.

Short-term courses are those dedicated to specific subjects of duration up to 100 academic hours. Long-term courses are provided first of all for civil and other engineers, who wish to specialise individually in a special topic under the guidance of a professor or lecturer chosen by them or by the related department or chair. An individual regular specialisation lasts from 6 months to 12 months and up to 18 months in case of extramural studies. Other type of long-term (usually 4 semesters, 90 classes per semester) courses are related to computer processing of information, computer technologies in design, management of land and estates etc.

The type of recognition depends on the type of courses. The corresponding documents are up to the national requirements for this type of education and have been approved by the Ministry of Education and Science. After completion of a short-term course each learner receives a certificate of professional qualification. The certificate for the long-term courses contains the average mark of all examinations passed, the mark of the graduation paper and the degree of the university diploma, of which the certificate is an integral part.

Regarding funding, all courses are paid by the learners themselves (about 90%) or by their employers (about 10%).

In concluding, the present provision of LLL in CE in the country meets the needs both qualitatively and quantitatively, having in mind the level of construction activity and the degree of computerisation. Steps are being undertaken towards development of distance education. However, at this stage it is estimated that the number of potential learners does not justify the corresponding expenses. Instead, it is better to form 'mobile' lecturing groups thus providing weekend LLL courses in regional or even smaller towns with groups of more than eight learners.

The LLL in CE organised and carried out to meet learners' interests at the best corresponds to the present day needs of the work market. A long-term strategy for priority fields of CE activities (rehabilitation and energy-saving reconstruction of old buildings, fire safety of structures etc.) worked out under supervision of the concerned authorities would canalise the efforts of potential learners to look for better application of their present knowledge and its further development through LLL. Much remains to be done by the universities themselves in analysing and updating curricula and syllabi stemming from the actual contemporary role of civil engineers in society, advances in technology, materials and management, systems of information etc.

5.2.2 Cyprus

The only provider of LLL in Engineering in Cyprus is the Technical Chamber of Cyprus (ETEK). Members of the Chamber are all national citizens holding a university diploma of any branch of Engineering. Provision of LLL in Engineering is a very fresh activity of the Chamber which launched its Centre of Continuing Education in 2004. On the other hand the only university unit that offers formal CE education in Cyprus is the Department of Civil and Environmental Engineering, which started its operation 2 years ago. The limited number of academic staff and above all its early stage of development do not allow for the present any additional activity in the Department, like the LLL one. In conclusion, all Cypriots practicing civil engineers, who in so far are graduates of foreign universities, have very few chances to attend LLL programmes in the country.

5.2.3 Czech Republic

The report on LLL activities in CE for the Czech Republic consists mainly from the response of the Czech Chamber of Chartered Engineers and Technicians (ČKAIT) and, therefore, it reflects mostly the institution's experience. However, in the Annexe there is a more or less comprehensive list of providers of LLL in CE in the country.

ČKAIT has an organised system of Lifelong education within which it runs one programme of LLL in CE. Every run lasts for 3 years, its 2nd run is active from 2004 till 2006. ČKAIT issues a catalogue of activities in a printed and electronic form twice a year. About 1600 activities are listed in the catalogue every year.

A chartered person can choose from two approaches of learning – through the ČKAIT programme of LLL or through an individual form of LLL. Lifelong learning is valuated by credits – the duty is to obtain 10 credits in the 2nd run between 2004 and 2006. Activities included in ČKAIT programme of LLL can be divided in three groups: (a) professional activities of other organisers, (b) explicit activities guaranteed by regional departments of ČKAIT, and (c) other LLL activities.

ČKAIT activities cover all CE and architecture subjects. ČKAIT offers short-term courses, but it is also possible to choose from longer courses, which are provided by Technical High Schools and Universities. ACT No. 111/1998 Col., on Higher Education Institutions and on Modification and Amendment of Other Acts allows studying single subjects with the possibility to complete the studies for those without so far finished higher education.

At the end of the 2nd run accredited professionals send notice to their regional departments about all their activities and obtained credits and then they receive a certificate of approval.

Regarding examples of good practice, ČKAIT, ABF and SEKURKON have developed an organising structure for educational activities. At the meetings and seminars questionnaires are spread to get feedback on quality of their activities. ČKAIT has built up a Managing and Accreditation Committee, which approves courses.

As a general comment, LLL in the Czech Republic is provided in sufficient range and scope. All accredited courses are accessible at www.ice-ckait.cz. Description of every course includes also the financial matters.

5.2.4 Denmark

The original report on LLL in CE activities in Denmark contained a list of LLL providers (shown in the Annex B) and the responses from some of them to a basic questionnaire. Consequently, what is transferred herein is a summary of the answers to relevant questions.

The volume of LLL programmes offered in CE in Denmark is not small. The major providers are: (a) Non-educational institutions (DIEU, IDA, FRI, TL, Dansk Byggeri) and (b) educational institutions, mainly from the tertiary educational sector. In the first group a large number of courses (80-400, depending on the institution) run annually with varying duration (most are 1 day-long and the rest is less than 5 days). The topics of the courses also vary and so does the type of recognition (for some courses a certificate of attendance is provided to the trainees, while other courses do not provide any official recognition).

The involvement of universities in LLL in CE in Denmark is in a dynamic stage. Of particular interest is the development of programmes of the ‘work-based learning’ type and also that of new teaching/learning paradigms - like problem-based and project-oriented approaches. Reference to theses activities has been made also in section 4 of this report. LLL activities in universities are normally organised and run by special units under the institution (e.g. centers of continuing education or continuing professional development). Other details of these courses, which are offered to all CE employees, technicians etc., are similar to those of the non-educational institutions.

5.2.5 France

France is among the pioneers of LLL in Europe. The State, the Regions and the social partners contribute to the elaboration of the politics of LLL (1.5 % of the French GDP in 2001). To favour the dialogue between these various actors, their representatives are members, at the national level, of the National Council for Lifelong Learning. Regions and the State share the responsibility of the implementation of training. The professional associations and trade-union organisations participate in the elaboration of the official arrangements of lifelong training, contribute to its implementation and to the management of the funds paid by the companies (taxes), collected by joined committees created on their initiative. Companies are at the same moment the privileged places of implementation of the training and, with Regions and the State, the main providers of funds for LLL.

In the private sector, whatever the size and importance of the company, the employees can follow, during their professional life, actions of lifelong training. The departure in training can be made as follows. (a) In the case of a company’s training plan, it includes all the actions of training which are for the benefit of the employer. The employee in training is in professional mission; he is paid by the company. (b) In the case of individual right to train (DIF), it allows every employee to bank time (20 hours of training per year), within the limits of 120 hours (6 years). The choice of the training is decided with the agreement of the employer.

On the other hand, public servants can also benefit from training periods within the framework of the training program on the initiative of the administration, or within the framework of the leave for training. The training plan includes all the training which the administration proposes to her agents. The agent is then considered during the training as in actual service. His salary is maintained. Leave for training is an individual right (by law) which allows the agent to follow a training of his choice during his working time. The agent on training leave perceives also a payment.

The participation of French civil engineers in LLL is the lowest of all activity sectors: 23 hours per person in 2002, as compared to 108 hours in the aeronautical sector, 55 hours in the communication sector, and 30 hours in the industrial sector (average 35.5 h for all activity sectors). This average duration in 2002 has to be compared with the same data in 1974: 63 hours. The 23 hours in CE correspond to 30 hours for people working in design offices and 22 hours for those working in construction companies. The reasons for this rather low participation rate can be explained as follows. (a) It is very difficult for civil engineers working on construction sites to follow training due to their activity all the week. (b) In design offices, the training in done all the year in the office itself with older staffs.

The interest in participation in LLL in CE activities for different age groups and the two genres is sketched in the following table (for 100 trainees, % of trainees).

Age group	< 25 years		25-44		> 45 years	
Genre	males	females	males	females	males	females
Construction companies	10.9	1.7	54.1	5.0	26.3	2.0
Design offices	14.7	9.0	34.1	23.0	13.1	6.1

The main providers of LLL in CE in France are associations - professionals or not – (60%), then companies (25%) and, finally, universities (15%). The lead of the associations is due to the fact that their structure is much more flexible in managing continuous training courses (due to temporary teachers' hiring just for the period of the training, the favorable fiscal rules regarding the taxation of profits etc.).

The prevailing types of teaching methods are short courses (up to a week) then seminars (one day duration) and long courses (up to 2 years). Generally for short courses, a certificate of attendance is delivered at the end of the course. For long courses (one year or more) a diploma can be obtained by those who have passed the relevant exams.

One of the most famous providers of LLL in CE in France is “Ponts Formation Edition”, a private society created by “Ecole Nationale des Ponts et Chaussées” to manage LLL in CE. “Ponts Formation Edition (PFE SA)” is - with more than 50 permanent people staff - the ENPC specialised subsidiary in continuing education with a turnover of 6.8 millions Euros. Amongst the main French engineering “Grandes Ecoles”, PFE has been leader in this continuing education area for many years, with more than 200 seminars held yearly in France and abroad, attended by about 6000 trainees. PFE implements training courses, but also manages the whole process of competencies evaluation, training needs assessment, and courses design with methods based on quality. Furthermore, PFE is able to contribute to organisation development processes based on functional analysis and strategic analysis which aim at establishing competence frames of reference for each kind of job. In different activity fields (building, roads, bridges construction, urban and territorial planning, water supply, environment, transportation, management, etc.), PFE’s training experience allowed it to maintain a close collaboration with the whole French technical network for important training programmes’ implementation. It is also specially targeted to civil servants, but also to research and engineering offices, laboratories, building firms and material suppliers. Abroad, in the same fields, PFE has performed a lot of punctual missions to support local clients (on-the-job seminars, workshops, individual or collective study trips in France, national project-teams training etc.), but also multi-annual actions in the framework of international biddings, with courses particularly devoted to local organisations’ institutional development. These actions are usually financed by the World Bank, European or French funds.

5.2.6 Finland

In Finland there are two universities offering CE education, namely the Helsinki University of Technology (HUT) and the Tampere University of Technology (TUT). They both provide LLL in the broad sense. In HUT, the main unit is the Department of Civil and Environmental Engineering (DCEE), but sometimes the Lifelong Learning Institute Dipoli provides LLL courses in CE as well. All DCEE laboratories and professional chairs are involved in LLL activities by participating in courses arranged by themselves or some other organisations, like the National Road Administration (RA), the Association of Finnish Civil Engineers (RIL), the Steel Association etc. At TUT the situation is similar. Sometimes the State Institute for Technical Research also arranges courses in this field. However, the most active of all is RIL. Roughly, the percentages of the contribution to the total provision of LLL in CE in the country are: RIL 60 %, HUT 15 %, TUT 10 %, others 15 %.

Particularly regarding the university-based provision of LLL, the two universities mentioned above provide high-standard LLL courses mainly for Diploma Engineers, i.e. their former students, while Dipoli at HUT offers courses to 'non-professional' or 'less-professional' persons as well as to engineers. As far as the duration of the courses is concerned, this is mainly short, except Dipoli that offers also long-duration courses. Finally, the prevailing type of recognition is a certificate of attendance.

A concluding comment is that LLL provision in Finland has proved to be a good system in which RIL takes the most responsibility by arranging a great part of courses. The disadvantage is that it works on a business basis that prevents individual engineers to participate because of relatively high costs. On the other hand, universities work on non-profit basis or on a low own-cost principle, and because of that, they are not very eager to carry the extra load. Consequently, LLL provision in the future should be made available to all Diploma Engineers in Finland on a regular basis.

5.2.7 Germany

There is a very high demand for LLL in the area of CE in Germany. This is explained by the fact that recently a new code generation was introduced in Germany which created a strong need for acquiring knowledge and abilities to work with the new regulations. In addition to this there is an accelerating application of new technologies and material which require certain knowledge or experience as a prerequisite. Another reason for the demand of LLL is the accreditation and certification within quality management.

LLL interest does not seem to be gender-specific but often linked to the work position, since certain LLL courses are prerequisite for promotions or for continuing work in a certain area. If an employee does not feel a need for promotion, the urge for LLL decreases, a fact that naturally leads to the effect that older civil engineers seem to have less interest in LLL.

A rough estimate of the nationwide provision of LLL is: 50% by companies, 35% by associations and 15% by universities or other schools. The differences in theses percentages can be explained by the following. Most companies provide LLL in Germany in order to offer their desired education and be able to monitor individual progress. This is also a more flexible approach as it interlocks with the every day working life as work-based learning. Due to accreditation, associations provide LLL courses which enable the participant to special work positions (i.e. Brandschutzbeauftragter = design for fire protection or SiGeKo = security and health coordinator) which they would not be allowed accreditation with the regular university degree. In many cases associations work together with universities in order to provide LLL courses. Since in Germany it is difficult for universities to receive payment for LLL courses, they shift to associations which coordinate courses led by university members.

Regarding the types of teaching/learning methods of LLL provision in Germany, it looks that a lot of courses from associations and universities are short-duration seminars. However, any kind seems to be rather equally represented in LLL activities in the country. On the other hand, most companies use a form of blended learning within their LLL courses.

Regarding the funding of LLL activities, basically all LLL is paid by the learners or by the employing company. Moreover, there are special grants within tax regulations which allow associations to gain more profit from their courses.

A final comment is that the application of modern communication technologies will enhance the access to LLL activities. With a more effective learning and the integration of LLL into the work process as a critical factor, activities in LLL will probably increase in the future.

5.2.8 Greece

Historically speaking, despite a very high demand for formal tertiary education during the last decades, in Greece there is no significant demand for educational activities outside the formal educational system. However, during the last decade and mainly driven by funding from the European Union (e.g. the Community Support Frameworks), LLL in the country has been modified drastically, as old and new institutions have been engaged in a more serious way in various activities.

In CE, but also in engineering in general, the demand for various types of LLL is limited, especially in older age groups. Civil engineers, working either in the public or in the private sector, and with some years of professional experience, are seldom seeking for organised continuing education courses, mainly because they don’t appreciate the merits of such an activity, which anyway is not offered in an attractive way. During the recent years and due to an increasing unemployment young engineers are looking for various types of LLL courses, almost immediately after, if not before, graduation.

The main provider of LLL programmes in engineering is the Technical Chamber of Greece (TEE), which holds more than 80% of the total provision in the country. Universities, private educational bodies and private companies share the rest 20% of the provision. Most of the courses offered are less than 100 hour seminars practically covering all topics, including ICT, needed for a young civil engineer. The majority of courses are self-funded, meaning that normally the trainee has to pay a rather moderate fee. Attendance is usually certified by an associated certificate.

TEE is the only example of good practice as provider of LLL in CE. Its “Institute of Education and Training of Members of the Technical Chamber of Greece” is an accredited organisation that offers a wide spectrum of numerous courses along the whole country through its local branches. Instructors are mainly university professors but experienced professionals also take part in a few specialised courses.

Private educational bodies and private companies are also taking part in the provision of continuing education in CE, but within a limited range of subjects and sporadically in time.

As far as the involvement of universities is concerned, the situation is complex. First of all Greek universities show the typical lack of motivation within academia commented in section 3.2. The low demand for non-formal educational programmes, particularly from professionals over 30 years old is a second reason. On the contrary, the operation of many new formal programmes of postgraduate studies in almost all Greek Universities, mainly at the MSc level, which are dynamically expanding since

1998, has created a very strong pole of attraction, especially to new graduates. This fact proves that the official recognition of studies is also a critical parameter in choosing among alternative education offers.

As a result there are few cases of LLL provision by universities. Only the National Technical University of Athens offers some continuing education programmes through its Centre of Continuing Education, but again at low rates. The Hellenic Open University is an institution that offers degrees to either university graduates or non-university graduate applicants in specific subjects, very few of which related to CE topics (e.g. environment).

In concluding, the lack of institutional organisation is the main reason for the very low involvement of HEIs in LLL activities. The example of the successful operation of the Technical Chamber of Greece in Continuing Education and Training of engineers could be used as a paradigm for the institutional organisation of HEIs. It is worth noting that in most seminars offered by TEE the educators came mainly from the academia. That means that , under certain circumstances, there is a positive inclination of academics to participate in this type of activities, a fact that could be taken seriously into consideration when designing a new system of university-based provision of LLL. In fact, quite recently (July 2005) the Greek government passed a law that could assist a lot towards a more active involvement of HEIs in LLL. The key institutional change that this law introduces is the official establishment of autonomous units within universities, the so-called “Lifelong Learning Institutes”.

5.2.9 Hungary

The provision of LLL in CE in Hungary is shared by a number of institutions. Calculated percentages (roughly estimates) of the contribution of each of them to the total provision in the country are: (a) Hungarian universities and university/college faculties providing LLL courses in CE: 75% (mainly continuing education, adult education, and continuous professional development courses for expert engineers). (b) European Union sponsored courses: 5-10 % (mainly vocational education and training programmes). (c) Courses organised by the Hungarian Chamber of Engineers: 5-10%. (d) Hungarian Ministry of Education and scientific societies: 5%.

Most of the courses are offered to both public and private employees and cover practically all major sub-fields of CE (structural engineering, geotechnics, hydraulic engineering, transport, construction management etc.). All types of courses, except those of Vocational Education and Training, are organised in the forms of tutorial and self-instruction or distance learning systems with long (3 or 4 year) duration. The vocational education and training courses are organised in the forms of tutorial and self-instruction systems with short (2-4 week) duration. The attendance of vocational education and training courses is recognised by a certificate of attendance, whereas that of all other types of LLL by a diploma.

As stated above, universities are the major providers of LLL in CE in Hungary. As a consequence, examples of good practice should be sought among them. Universities provide a series of post-university education, expert engineering courses, characterised by the variety of their purpose, content, methodology and timeframe. This form of education assumes regular lectures. At the end of the course a certificate is awarded to the participants when the diploma work is defended and the final exam is passed.

The courses offered by the Hungarian Chamber of Engineers are organised by its appropriate sections according to the interest of the engineers. The courses are mainly informative. In recent years the Structural Engineering Section has organised such courses about designing according to Eurocodes. Professors of universities are also involved in these activities. A typical example is a TEMPUS project of which the teaching program was related to the harmonisation of EU and Hungarian standards. Three working groups developed the material of the three pilot courses, namely for civil, mechanical, and electrical engineering. These developments matched the Hungarian Chamber of Engineers's expectations in terms of quality and scope. The support given by the involved academic and institutional partners was satisfactory. The mobility of pilot course participants to the partner universities and institutions involved in the project turned out to be very useful. In the end, the knowledge of European engineering standards enhanced the competitiveness of the Hungarian engineers in their work.

A second example of European Union sponsored project is the Leonardo da Vinci programme NFATEC ('A New and Flexible Approach to Training for Engineers in Construction'). This project aimed at developing a framework system which is based on both direct tutor-to-delegate contact and web-based distance learning methods and which combines the elements of the traditional and classical distance learning.

5.2.10 Norway

The main providers of LLL activities in Norway include a number of universities, the Norwegian Society of Chartered Technical and Scientific Professionals (TEKNA) and various internal company training providers. A rough estimate of contribution percentage is: universities 85%, TEKNA 5%, others 10%. The Norwegian University of Science and Technology (NTNU) holds 60% of the country's provision, meaning that, by far, it is the major provider of LLL activities in Norway, whereas TEKNA is the main provider outside universities.

In the university sector, NTNU main activities include continuing education and continuing professional development. The university has a separate administrative unit, while the faculties and departments are professionally responsible for the course provision. Offers are country-wide with participants from private industry and public authorities. A rough estimate of percentages between these would be: public 60% and private 40%. The majority of programmmes/courses are long courses giving a predetermined credit, while TEKNA offers no-credit short courses of 2-3 days duration. Subjects range from geomatics, transport safety, project analysis and planning, sustainability and sustainable energy-efficient buildings, hydraulic engineering and hydraulic structures, project management, road and railway engineering, coastal engineering, etc. For the credit courses, the participants are taking exams and get a certificate of attendance including a grade transcript. The other 6 universities offer various courses in specific topics that all together form an interesting and useful collection for all civil engineers.

Undoubtedly, NTNU is the example of good practice in the country. The separate administrative unit handles all administrative matters and has developed extensive cooperation and relationships with potential participants and organisations. The faculties/departments carry the professional responsibility for the content and the running of the courses, including examination procedures. Some of these courses are developed as net-based courses, while others are given as campus-based courses, where separate facilities and rooms are available. Teachers are quite often a mixture of university teachers and experts from the industry and/or public authorities. The courses offered at NTNU are assessed by external organisations as being of a good quality, providing ample opportunity for employees to go into further competence building. The courses are generally recognised as being fully competitive and providing an adequate educational offer.

LLL in CE is expected to increase in general, reflecting that the long-term market demand will exceed what is currently offered today. A market investigation is under way, and the future direction will probably be to develop “clusters” of courses within the same field, covering larger breadth, and possibly included in MSc ‘packages’. In addition, there will be a trend towards higher course fee to cover the actual costs for running the courses, and to provide some incentive funds for the continuing education activities.

5.2.11 Poland

The following types of providers of LLL are actually active in Poland: (a) Technical universities (public and private) with different structures of the providing units (faculties or departments of CE, career offices as separate university units, and LLL offices also as separate units). (b) Building research institutes (e.g. Institute of Road and Bridges, Institute of Building Techniques, and Institute of Basic Technical Problems of Polish Academy of Science). (c) Professional associations (Polish Association of Civil Engineers and Technicians, Polish Chamber of Civil Engineers, and Association of Road Engineers and Technicians). (d) Private companies of various types providing LLL in the form of short courses or training. (e) Combined actions (i.e. universities and associations, building research institutes and private ones).

The percentages of the contribution of each of the above categories to the total provision of LLL in CE in the country (estimated roughly) are as follows: Technical universities 60%, research institutes 15%, professional associations 15%, and private companies 10%.

At the moment LLL in CE activity results in Poland are not satisfactory. Only very few examples of good practice can be presented. One good example is the Roads and Bridges Research Institute (IBDIM) in Warsaw. This Institute offers a large number of LLL educational packages of short duration (1-5 day), like specialised and training courses, seminars, workshops and conferences. The learners are mostly civil engineers from the public and private sectors, but technicians, students and other individuals are also allowed to participate in some specific programmes. The recognition of attending all these activities is normally through a certificate or a diploma.

The participation of Polish universities and other institutes in LLL activities is stipulated in the Higher Education Act; however these activities are not compulsory. The majority of Polish universities are actually providing some various types of LLL in CE education but mainly these events are organised occasionally, not systematically. Due to the very big number of student population in CE faculties the academic staff of Polish technical universities is highly engaged in formal education activities for daily and evening courses. As a result, the teachers could not actively participate in additional learning activities like LLL.

On the other hand, the LLL-related education in the Universities is recently more and more stimulated and affected by firms and professional associations. In some cases these firms order the courses or cooperate with university units to create programmes of LLL in CE. A barrier of wider participation of Polish engineers in LLL is also the financing problem, because many Polish firms can not reimburse the costs of courses to their own employees.

A detailed analysis of the programmes/courses of LLL in Poland allows to state that - in most of the cases - they are very attractive. They rely on references to updating knowledge in respective subjects of CE, mainly in the fields of application of new European Standards (Eurocodes), technologies and methods of design, especially computer aided design, and of use of new building materials. Moreover, these programmes are open to a wide audience and, above all, those who attend them are given appropriate certificates or diplomas, which is very important for upgrading their professional status.

5.2.12 Portugal

The original report of Portugal, although extensive, does not provide specific information on the status of LLL provision in CE, except of a few references (shown in the Annex B). Hence, herein only some critical points are extracted from the general description of the LLL status in the country.

Public universities had no historical reasons, namely financial, to be concerned with LLL and to some extent have been kept and keep themselves apart from this process. In fact, LLL provision by universities is a very new, still minor activity. The idea that LLL is a function of the universities only recently won ground, particularly after such recognition of the Rectors Council. Formal postgraduate courses in universities are also a quite recent creation.

Generally speaking, Portuguese universities have not identified key actors responsible for LLL and do not have special units in charge of regular services for that purpose. Most of the LLL activities are carried out at the level of faculties or departments. Moreover, in general, there is no central strategic thinking at university level and, as a result, co-operation between departments, faculties and universities is incipient. Some departments or faculties that organise CE activities within universities have developed their own support structure, generally by means of department interface institutions, with all the management and financial constraints this implies. It is now increasingly clear that co-operation between departments and faculties is a key issue for success. It will be an obvious way to achieve the necessary critical and financial dimension that will allow stable self-supported university-based provision of LLL activities.

The lack of motivation of university professors to participate in university-based LLL activities is one of the most important obstacles for its development. There is no official academic recognition for such activities in the public universities and, consequently, motivation appears often linked with financial incentives. However, experience shows that universities can not compete against the private companies that pay directly the teachers of their LLL programmes. Because of this situation and the lack of strategic approaches by the universities, an important part of LLL activities for graduate people is organised by private companies although often using, ironically, teaching staff from the universities. This is especially true in areas like Economy, Management and Engineering.

In concluding, there is still a great unawareness of the importance of LLL, either within the universities or in the society. Speaking to distinguished professionals it turns out that they are generally not willing to go back to school and are not convinced of the utility of doing so. The direct transfers from the state budget to the public university budgets are limited to initial education and research, not including LLL activities. In addition, competition in an open market is something that universities are historically not used to enter to and is very difficult to achieve with their regular organisational structures. Generally speaking, universities lack well-defined strategies and the central co-ordination of the existing activities is rare.

Despite all that, there are encouraging indicators. The production sector is becoming more and more aware of the general benefits of continuing education. There is already a vast market for continuing education and training of university graduates. There is a growing consciousness that the relative low level of qualifications of Portuguese active population when compared with other European countries can be only overcome if LLL is systematically implemented. It may then be stated that universities should move steadily into LLL and it can be forecasted that they will do so. As a result, the offer, today centered at institutions outside the formal education system, will be substantially altered both in terms of spectrum and quality.

5.2.13 Romania

The report of Romania is limited only to information on a number of universities that provide some types of LLL activities. The list is given in the Annex B.

Some additional information can be retrieved from the lists of LLL courses provided by two universities, namely the Technical University of Cluj-Napoca and the University Politehnica of Timisoara. These courses cover various scientific branches within CE and are in the form of lectures, laboratory work and applications. Most of them are of long duration (3-15 weeks), while recognition of attendance is in the form of a certificate or a letter.

5.2.14 Russia

There are more than 120 universities in Russia providing CE education, including 15 specialised CE universities (their list is given in the Annex B). In other technical universities there are CE faculties. The major providers of LLL in CE in Russia are universities. The percentages of the providers are: Universities 70%, other educational centers 25%, other organisations 5%. Learning centres on LLL operate in different regions of Russia. As examples of good practice can be considered the Moscow State University of Civil Engineering and the Voronezh State University of Architecture and Civil Engineering.

The trainees of LLL in CE programmes are either specialists in CE with graduate (engineers) and undergraduate (technicians) education or public employees, practicing engineers, and executives of construction companies. The types of the offered programmes are: (a) Short-term professional development courses (around 70 hours). (b) Long-term professional development courses (more than 100 hours). (c) Retraining courses (556 hours and more). (d) Seminars and conferences (1 day and more). The content of the courses cover all aspects (more than 100 specific sub-topics) of CE.

Various kinds of certificates are provided as a means of recognition of the attendance of all relevant courses. The typical ones are: (a) State certificate on short-term raining. (b) State certificate on long-term training. (c) State diploma on retraining. (d) Moscow State University of Civil Engineering certificates confirming attending of conferences, seminars and special lectures. In general, the assessment of personal qualifications of workers and young technicians is on the responsibility of the Federal Agency, whereas that of specialists and leaders is done by the Federal Licensing Center after additional learning in different programmes, like the ones mentioned above.

The need for LLL in Russia is very high. Every learning center can educate more than 3000 specialists every year. The main reason of such a high demand for LLL is the introduction of new technologies and new building materials and constructions, constructing of new unique buildings (e.g. high-rise buildings – higher than 40 floors) etc.

The interest in participating in LLL activities covers all age groups (25-60 years). Men and women are equally seeking for such participation, either state employees or employees of private companies. On the other hand, the type of LLL ‘work-based learning’ takes place only at a small rate. Finally, organisations and firms, which are directing their employees to attend LLL programmes, finance their education.

5.2.15 Slovakia

The demand for participation in LLL by civil engineers in the country is high. That includes public and private employees from both genres and, practically, at all ages within the range of the professional life. This positive attitude exists because, in order to be allowed in specific activities (i.e. design, supervision, head of construction site), civil engineers should pass an examination and present the portfolio of activities. Every year the Chamber of Slovak Civil Engineers checks the number of credits obtained from participation in courses or seminars, but also from published papers in proceedings or in professional journals.

The main providers of LLL in CE in the country are the Chamber of Slovak Civil Engineers (CSCE) and the Universities**.** In particular, CSCE is, according to the current legislation, the only authority that attributes authorisation for this specific profession.

Of particular interest is the fact that, in the frame of a European Tempus project, the WBL methodology has been developed by the faculty of Civil Engineering of the University in Žilina for building maintenance activities. Slovak Road Administration and Slovak Railways also make use of this approach in their LLL activities.

An ‘exemplary’ case of LLL provision in the country is the Institute of Continuing Education, established as an integral part of the University of Žilina in 1996. It is a center providing the system of continuing education for all-age categories with a qualitative system of study support and following the latest trends in technology and science. When forming and implementing flexible educational programmes of continuing education, the Institute uses the university’s technical background and contracting partners´ cooperation with the support of information and communication technologies. By its organisational structure it offers professional education, language education and education for seniors. The Institute organises and offers a variety of programmes, courses and consultancy, either through conventional seminars/training or through e-learning courses.

In general, the prevailing type of teaching/learning methods of LLL provision is through seminars and short courses, while a few providers employ new methods, such as e-learning and distance learning. Finally, as far as funding is concerned, the major income comes from fees paid by the learners and their companies.

5.2.16 Spain

Mainly due to a lack of tradition the demand by civil engineers for participation in LLL activities is so far quite low. An exception is MBA studies, but this comes as a specialisation quite a few years after graduation. However, there is recent tendency by Universities to provide a number of specialisation courses intended to public and private employees. On the other hand in Spain there is no unemployment in CE, and, therefore, LLL is of no use to unemployed graduates, a case mostly encountered in other countries.

LLL providers include almost all different possibilities: professional associations, private companies, public companies, universities etc. In any case, in Spain, the Professional Association has very important links to the universities, and therefore courses are usually organised together.

For public employees, courses take place mostly at the institution. The public body provides internal courses (even language courses) for employees. These courses take place within regular working hours, and mostly within the facilities of the institution. Private institutions and professional associations rely more on Universities. In this second case, these courses are carried out outside the normal office hours.

As far as the types of learning/teaching methods are concerned, again, there is a wide variety. There are seminars, short courses, long courses etc. New methods are also in use. For example, the University Polytechnic Catalunya offers two specialisation post-graduate courses in CE which use e-learning.

When courses are taught at the University, accreditation is automatic. Courses offered at the institutions are mostly only internally recognised. This recognition, given in terms of certificates of attendance, is quite useless when trying to change jobs.

Regarding funding, mostly fees are paid or co-financed by the companies. Whenever the company organises the courses they are basically free, and the company carries on with all expenses (basically those of instructors, sometimes selected from the own institution).

In concluding, there is an increasing interest in LLL. Therefore great changes are expected with time. Actually, a big change has been observed regarding language courses (this is outside universities). Moreover, universities are gradually increasing the number of offered courses, a fact that seems to attract more and more people every year.

5.2.17 Turkey

The main providers of LLL in CE in the country, excluding universities, can be classified in two categories: public organisations and private companies. In the first category LLL activities are provided by the Turkish Chamber of Civil Engineers (TCCE), the General Directorate of State Waterworks, the General Directorate of State Highways, Municipalities, and most Ministries. In the second category the provision is made by sectoral private organisations, structural material producers and/or providers, and private companies. As the report for Turkey was prepared mainly by the TCCE, information on LLL activities in universities is herein quite limited (only a brief list of them is given in the Annex B).

Among the public organisations above, only TCCE provides the regular LLL as the institution itself, with the optimum prices and participations in Turkey. Other public organisations and institutions provide their staff opportunities to LLL offered by other institutions, either public or private. As a reference to present planning process of LLL in Turkey, it is foreseen that the above listed major public providers of LLL in CE will generally provide the continuing professional development type of programmes to their members.

Private companies mostly organise vocational training courses to update civil engineers about new construction materials and/or software which they produce, import, or export. Training for utilisation of such a product constitutes an important part of the activity.

The Turkish Chamber of Civil Engineers provides most of the contribution regarding the LLL activities in the country. The extent of TCCE's contribution is well over 70%, because TCCE's LLL activities are open for all member civil engineers and the activities are spread throughout the country. Percentage wise contribution of the other public organisations is roughly around 25%, thus leaving a 5% contribution share to private companies. Private companies generally offer LLL services in forms of specialised conferences or lectures where their new materials and/or software are introduced to limited audiences. Apart from TCCE, the rest of the providers prefer to run their activities in large urban centres, which leads to a percentage of LLL converging to zero for non-metropolitan cities in Turkey.

The TCCE provides a wide variety of programmes depending on the demands received from the members or necessities urged by the construction sector. The LLL activities of the TCCE are open to all its members in the country, regardless of whether they are private or public employees or unemployed civil engineers. TCCE also provides courses for technicians and skilled workers. Almost in all activities, the TCCE receives support from academics of different universities and professional experts. Congresses, seminars, panels and workshops are organised with a great scientific support of universities, where new technologies, new materials and new facts are included and considered.

Although CPD application has not been started yet, TCCE provides two types of course attendance recognition: (a) a certificate of attendance, which certifies that the engineer has participated to the relevant course, and (b) a certificate of achievement, by which the engineer is certified for participating as well as being successful at the relevant course test exam.

In concluding, the provision of LLL in CE is carried out by a limited number of organisations in Turkey. This must be well organised and centralised to maintain the success and sustainability of LLL. Provision of LLL in CE has to be considered by all organisations (state and private) at a more extensive manner and the service should cover more engineers. A sound and reputable accreditation, based on international registrations and memberships to organisations such as ECCE, FEANI, EMF, etc. would, in the case of TCCE, attract colleagues to LLL programmes.

5.2.18 United Kingdom

The practice of LLL in the UK has a long tradition as well as very high participation rate compared to the average European one. Specifically, the demand for LLL in CE is also high. There is a strong professional awareness of the need to keep abreast of developments, which are related to professional needs. On the other hand there are several reasons why there is an ethos for supporting LLL. (a) The need to keep abreast of the application and changes in Codes of Practice for design. (b) The realisation that changing from a technical to managerial role requires the acquisition of new skills. (c) The “matching sections” requirement for professional membership of the engineering institutions. This requirement involves satisfying an approved course of learning.

Practicing civil engineers would regard LLL as age independent. However, the specific type of learning could be related to age and career progression. Thus, engineers would seek professional membership early on in their careers and might follow ‘matching sections’ opportunities between 25 and 34 years. Engineers in mid-career would seek LLL opportunities in the area of management. New developments and innovative ideas in LLL would be pursued by all age groups.

Regarding any observed differences between various groups in the demand for LLL, there is no essential difference in the requirements of either sex. There is equality, which is bound by law, but the number of female civil engineers is small. All other types of groups (e.g. private employees, public employees and unemployed) would share a common professional responsibility to undertake LLL.

The main providers of LLL are universities and other educational establishments. Some private organisations offer training schemes, but generally LLL is conducted in educational establishments. As far as funding LLL activities is concerned, universities have become more or less financially independent in recent years. The opportunities, which have been presented to them as LLL providers is seen as an additional source of income. They have existing facilities and expertise, which gives them a competitive edge over commercial organisations.

The structure of provision of LLL differs among the providers. Universities are now coordinating their LLL effort in Centres of Continuing Education. The Centre may act as an umbrella for department activities or it may be a provider in its own right. In the latter case many external lecturers will be employed on a part time basis. Private organisation will not have this structure. However, some organisations will deliver their LLL activities on university premises.

Larger organisations find it more effective and economic to invite say, two or three lecturers to deliver a weeks LLL experience to employees. Such an event would take place at the company training center and involve many employees. This is regarded as work-based learning.

Regarding examples of good practice, there would be too many cases to quote. For instance, most individual modules of Masters programmes are offered as LLL opportunities. These are often advertised nationally in the press. In particular, a great deal is mentioned about the learning methodology and their relevance to professional practice. University websites in the UK show a great deal of relevant information.

In trying to identify the prevailing types of teaching/learning methods it is not possible to be specific since LLL is delivered using all the available educational techniques. It is a matter for each course regarding its delivery. On the other hand, provision is usually achieved in short (1, 2, or 3 day) courses or seminars. In these cases, e-learning methodology can be employed to provide preliminary reading material and be used in any type of conventional teaching/learning approach.

The issue of accreditation and recognition of LLL activities is not unique for all kinds of providers. As stated above, the providers of LLL in the UK could be universities or private organisations. The former would, most likely, be accredited for the purpose of providing professional education. Traditionally this education has been provided at the undergraduate level. However some professional bodies are moving towards accreditation of Masters programmes. This implies that LLL modules, which are part of Masters programmes, would become accredited under the ‘matching sections’ scheme. Private providers are unlikely to be accredited, but recognition is likely, in the form of certificates.

The provision of LLL for civil engineers is outside the normal government funding of higher education. Thus, the providers of LLL would charge an economic fee. This fee could be paid by the individual attending the course, by a sponsor or employer.

Two concluding comments for the current and the future status of LLL provision: (a) There is no doubt that LLL is accepted as a professional responsibility by civil engineers. However, there is no specific legal structure that governs the procedure as is the case with under-graduate and post-graduate education in the UK. (b) The position is not likely to change in the immediate future.

6. CONCLUSIONS

6.1 Summary of the main conclusions

As stated in the ‘Introduction’ of this report, the main aim of the work of EUCEET’s SP.12 was to bring together in a concise way and from within a European perspective the basic issues that are relevant to the participation of civil engineers in LLL activities. The particular objectives were expressed as: (a) reporting on LLL in CE in Europe, especially on current activities and prospects of all types of LLL providers, (b) identifying strategic factors and key processes in successful provisions of LLL, and (c) assessing critical factors and proposing actions for a wider involvement of HEIs in LLL. In the present sub-section the main conclusions from the whole exercise of SP.12 are summarised and presented. In the following sub-section some recommendations are given for a more effective and wider implementation of LLL in CE activities, specifically concerned with the university-based ones.

The report is structured in 7 sections and two Annexes. Following the introductory Section 1, where all information on the history and working methods of the WG of SP.12 is presented, Sections 2-4 include definitions of concepts and other terms relevant to LLL, information on the history, methods and strategies of LLL as implemented in Europe, and particular information on all aspects and issues of LLL implementation as related to CE. The contents of Sections 2-4 were the outcome of an extensive literature survey, the main sources of which are cited in Section 7 (‘Bibliography’). On the other hand, Section 5 contains the summaries of reports that have been prepared by members of the WG of SP.12 as well as by other members of EUCEET, for 18 European countries. These reports focus on LLL in CE activities in the particular countries and express both real data/information and personal views of the reporters. Above all, the information appearing in Section 5 can be considered as valuable in terms of its originality, as the discipline of Civil Engineering is quite seldom referred to in the literature alone, particularly as far as the activities in LLL are concerned. Finally, the contents of Section 5 are supplemented by a series of tables included in the Annex B, where the names and websites of institutions that provide LLL in CE are listed.

Everything that follows in the two sub-sections of Section 6, is based on both volumes of information mentioned above, that is the contents of the literature survey appearing in Sections 2-4 and the original national reports in Section 5.

The first big issue that has been addressed in the present study refers to the target groups of LLL in CE and the associated demand for it. In most countries the trainees are mainly professional civil engineering degree holders, but there are few cases where other groups related to CE are also involved in these activities (e.g. civil engineering trained technicians and non-educated or non-skilled workers). Employed civil engineers seeking for LLL come almost equally from the public and private sectors, while the percentage of unemployed young graduates seems to rise. In general, age is a dominant factor in the demand for LLL, with older professionals being more or less reluctant to participate in any form of LLL. On the other hand, gender is not a significant factor in the demand for LLL.

The demand for participation in LLL by civil engineers varies considerably among the reported countries. It looks that the key factors that affect demand, either alone or combined, are: (a) the general tradition as well as the national strategy on LLL activities in each country, (b) the perception or the realisation of the benefits of LLL by the workforce in general, (c) the rate of unemployment, (d) the quality and sufficiency of the provided education both in the formal and non-formal types, (e) the accessibility to these types of educations, and (f) other issues, like recognition, accreditation, financing etc.

A second major issue, which is of paramount importance to HEIs, is the provision of LLL. First of all, the prevailing forms of LLL are those of Continuing Education and Continuing Professional Development. These are usually offered within the providing institutions, but in a few countries work-based learning is also gaining ground. As far as the providers themselves are concerned, the picture is also diverse. Normally, professional associations are more flexible and thus capable in organisational terms, as compared to other bodies, to offer a wide range of courses, usually at all locations where they operate their branches. Consequently, where other potential providers, particularly universities, are indifferent or incapable to organise similar activities, professional organisations hold a very high part of the LLL provision countrywide.

On the other hand, there are countries, usually with a long tradition in LLL and, above all, with high encouragement and/or financial support by the government, in which the HEIs are deeply involved in the ‘market’. In these cases the organisation and management of LLL provision is usually achieved through specific centres or departments, which operate either as autonomous bodies within the university or as units supervised and controlled by the institution. In general, the involvement of European HEIs in LLL activities is low and that affects equally, if not worse, the technological sector, including CE.

Finally, a small, but not insignificant share among the providers of LLL in CE hold some private educational organisations as well as large technical companies and firms, which operate their own units in any of the related forms of vocational, continuing, or professional development education.

The formats of the provision of LLL in CE vary too. Still, the prevailing one is that of the short-course type, which exists almost in all offered LLL programmes. Other common formats are: long courses, lectures, conferences, workshops and seminars. The delivery of LLL is made in most cases in the traditional way, which is in-class teaching (or face-to-face learning). Still, the invasion of new technologies in education has encouraged the application of other forms of teaching and learning, such as open and distance education, correspondence education, computer-based education, and telematics-based education (i.e. with the use of CDs, multimedia or video-conferencing).

In summary, both the literature survey and the individual reports from the EUCEET members show that in all cases, in which there is enough experience from the implementation of LLL in CE, there are no negative signs regarding the usefulness and the overall efficiency of all related activities. On the contrary, it is well recognised that LLL in CE is today not only a necessity for the respective workforce but also a challenge for the providing institutions, especially the universities. The issues presented in this report are the key factors of an activity that has already shown its vast potential as well as its high importance for the society. The final conclusion is therefore that LLL should be a primary target of all HEIs, which, to this end, have to adapt their own strategic plans towards a wider and more effective participation in this type of activities.

6.2 Recommendations

In the sense of the preceding paragraph, and specifically of the very last sentence of it, the present sub-section aims at summarising some recommendations mainly addressed to universities, in order to achieve a wider involvement in LLL. Most of these recommendations, which are derived from the literature review and appear in various sections of this report, were actually verified as quite useful, when examining the contents of the national reports presented in Section 5. First of all, there is the issue of the low interest from the universities in integrating LLL programmes into their system. This issue was discussed in sub-section 3.2, where the main reasons of such an attitude were highlighted, despite the obvious and direct benefits that are expected and which had been already experienced by those HEIs with a successful background in LLL activities.

As mentioned in sub-section 3.2, in order to become mainstream LLL providers, universities should: (a) Reconsider their approach and relationship to LLL and integrate it into their overall strategy and mission. (b) Adopt internal policies to promote the recognition of all types of LLL that they offer. (c) Develop mechanisms capable of assuring a continuous and adequate financing of these activities. (e) Facilitate access to learning opportunities. (f) Provide well defined and designed programmes. (g) Make the whole process attractive to their teaching staff, mainly by balancing all teaching duties (typical and LLL) and offering additional career advancement rewards. (h) Above all, make LLL a distinct and distinguished characteristic of their institution as well as a component that will add extra value to its overall pursuit of excellence.

In the whole process of such a change in the policies of HEIs, the institutions have to learn from the experience of the already operating various types of LLL centres – particularly of the examples of good practice ones – but also they have to make their own studies, taking into account the full spectrum of critical factors. A useful guide to this task is the study of E4 mentioned in sub-section 4.2 and briefly presented in table 4.1 of the present report. According to that study particular sets of recommendations were proposed for various critical issues, such demand analysis, product design, marketing, and sharing ODL materials.

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7.2 Sources for further reading

7.2.1 Internet sources

Further references specifically related to LLL and/or civil engineering education issues can be also found by browsing the websites of the associations etc. given in Annex A. For a broader picture of these issues the most important Internet sources are listed in Table 7.1.

Table 7.1. Internet sources

Source	**Website**
EUROPEAN COMMISSION: DG Education and Culture	http://europa.int.comm/education
CEDEFOP	http://www.trainingvillage.gr
Eurydice	http://www.eurydice.org
OECD	http://www.oecd.org
UNESCO	http://www.unesco.org

Official documents published by national authorities up to the year 2001 can be found in Eurydice (2001). In the same publication the websites of various national sources of relevant content are also provided.

7.2.2 Scientific journals

A vast collection of scientific papers dealing with all aspects of LLL and/or civil engineering education and training is being published in various journals worldwide. In the following Table 7.2 an indicative list of such journals is provided.

Table 7.2 Scientific Journals

Title	**Publisher**
Adult Education and Development	IIZ/DVV
Comparative Education	Taylor & Francis Ltd
Education and Training	Emerald Group Publishing Ltd
European Journal of Education	Blackwell Publishing Ltd
European Journal of Engineering Education	Taylor & Francis Ltd
Global Journal of Engineering Education	UNESCO Int. Centre for Eng. Educ.
Higher Education	Kluwer Academic Publishers
Higher Education in Europe	Taylor & Francis Ltd
Intl. Journal of Cont. Engn. Education and Lifelong Learning	Interscience Publishers
International Journal of Lifelong Education	Taylor & Francis Ltd
International Journal of Training and Development	Blackwell Publishing Ltd
Journal of Adult & Continuing Education	NIACE
Journal of Engineering Education	ASEE
Journal of European Industrial Training	Emerald Group Publishing Ltd
Journal of Further and Higher Education	Taylor & Francis Ltd

Journal of Professional Issues in Engn. Edu. and Practice	ASCF
Journal of Vocational Education and Training	Triangle Journals Ltd
Journal of Vocational Education Research Open Learning: the journal of Open and Distance Learning	H.W. Wilson Company Routledge, Taylor & Francis Group
Studies in Continuing Education	Routledge, Taylor & Francis Group
Studies in Higher Education	Taylor & Francis Ltd
Studies in the Education of Adults	H.W. Wilson Company

ANNEX A

	SEFI	**European Society for Engineering Education**

Website: http://www.sefi.be

Profile: Established in 1973, SEFI is an international non-profit organisation registered in Belgium. It is the first example of an association directly linking the institutions of higher engineering education, hence independent of national and/or community filters in establishing its policy, as an international forum for discussing problems and identifying solutions relating to engineering education. SEFI is presently a network consisting of 474 members in 45 countries, including 230 universities and engineering schools, associations, companies and individuals.

Mission/Activities: SEFI's mission comprises: to develop and strengthen the situation of engineers in Europe; to provide services and improve the circulation of information on the training of engineers in Europe; to improve the communication and exchange between teachers, students and researchers; to develop cooperation between different types of education/training organisations; to strengthen cooperation between industry and all those involved in education/training activities for engineers; to promote the European dimension in engineering education/training. The activities of SEFI include an annual conference, permanent working groups and task forces, ad hoc committees, European projects, seminars, publications and periodicals.

Relation with LLL: Strong (Most close connection is with SEFI's Working Group on "Continuing Engineering Education").

European Council of Civil Engineers	**ECCE**	**European Council of Civil Engineers**

Website: http://www.eccenet.org

Profile: Established in 1985, ECCE was created out of the common concern of the professional bodies for civil engineers in Europe that the civil engineers working together across Europe could offer much more to assist Europe advance its built environment and protect the natural environment. ECCE comprises national organisations which represent the interests of professional civil engineers. Only one organisation may represent each country which is a member of ECCE. At present the membership comprises 21 EU/EFTA countries.

Mission/Activities: At the European Union level, ECCE aims to promote the highest technical and ethical standards, to provide a source of impartial advice, and promote co-operation with other pan-European organisations in the construction industry. ECCE also advises and influences individual governments and professional institutions, formulates standards and achieves a mutual compatibility of different regulations controlling the profession, and formulates standards for a "Code of Professional Conduct for European Civil Engineers" and disciplinary procedures applicable throughout the Union. ECCE, through its 4 task forces and 1 working group, is active in such areas as the environment, research and development, education and training, continuing professional development, ethics and heritage, as well as in organising workshops and conferences.

Relation with LLL: Close. (Most close connections are with ECCE's Task Forces on "Education" and "Professional Recognition").

	CESAER	**Conference of European Schools for Advanced Engineering Education and Research**

Website: http://www.cesaer.org

Profile: Established in 1990, CESAER is a non-profit international association of about 50 leading European engineering universities, colleges and schools from 22 countries engaged in advanced engineering education and research and dedicated to research lead teaching. CESAER members are committed to the development of engineering education in order to be able to respond to the changing demands of the European society in a global environment.

Mission/Activities: The main objectives of CESAER are to provide *high quality* engineering education in Europe and to improve links among its members in research and in postgraduate and continuing education. CESAER set up various groups and pursues its aims through consultations between the members on a regular basis, development and implementation of programmes of multinational engineering educational at all levels, cooperation with European and national governmental institutions, agencies and other university networks etc.

Relation with LLL: Close

	IACEE	**International Association for Continuing Engineering Education**

Website: http://www.iacee.org

Profile: Founded in 1989, IACEE is an international non-profit and non-governmental organisation aiming to support and enhance lifelong technical education and training and advanced engineering education worldwide, including the special needs of the developing countries. The current membership of IACEE goes up to 438 individuals from 72 countries worldwide.

Mission/Activities: IACEE receives its principal support from various national, regional and international organisations engaged in continuing engineering education. The association's objectives are pursued by promoting international technology transfer through a better understanding of the continuing education process, improving the quality of education and training of engineers and technicians, developing and strengthening cooperation between education and industry, promoting the establishment of centers for continuing education, initiating international and regional meetings/conferences etc. Other activities of IACEE include committees/working groups, publications, projects and awards.

Relation with LLL: Very strong.

	CEDEFOP	**European Centre for the Development of Vocational Training**

Website: http://www.cedefop.eu.int

Profile: Founded in 1975, CEDEFOP is an active information provider and source of reference for information on vocational education and training systems and policies generally. It also carries out scientific analyses and overviews of research results, innovation and other developments.

Mission/Activities: CEDEFOP promotes mutual learning and understanding of key issues by examining developments and explaining and interpreting them. By facilitating exchanges, cooperation and synergy between all concerned, it seeks to develop a concerted European approach to vocational education and training problems. In fulfilling its role CEDEFOP provides services such as: (a) information on vocational education and training, (b) promoting and interpreting research and the identification of innovation, (c) support to meet the specific needs of CEDEFOP's partners (i.e. European Commission, European Parliament and other European institutions; Member States; social partners; other policy-makers, including local and regional authorities; vocational education and training researchers and practitioners; associated and EU applicant countries), and (d) providing forums for debate and links between policy-makers, social partners, researchers and practitioners.

Relation with LLL: Strong

	FEANI	**European Federation of National Engineering Associations**

Website: http://www.feani.org

Profile: Founded in 1951, FEANI is a federation of professional engineers that unites national engineering associations from 26 European countries, thus bringing together more than 80 national engineering associations. FEANI is a founding member of the World Federation of Engineering Organisations (WFEO) and is officially recognised by the European Commission as representing the engineering profession in Europe. The General Secretariat of FEANI is located in Brussels.

Mission/Activities: FEANI's objectives are: (a) to affirm the professional identity of the engineers of Europe, and (b) to strive for a single voice for the engineering profession in Europe, whilst acknowledging its diversity. FEANI has two committees, which help to pursue the federation's objectives: The Committee on "Continuing Professional Development" (CPD), and the "European Monitoring Committee" (EMC). The tasks of the Committee on CPD, established in 1993, are: (a) to implement FEANI policy on continuing professional development, (b) to assist the Executive Board of the federation in the development and formulation of FEANI positions and policy in respect of continuing professional development, and (c) to advise the Executive Board concerning issues related to continuing professional development.

Relation with LLL: Strong (Closest connection with the Committee on CPD).

	EURETA	**European Higher Engineering and Technical Professionals Association**

Website: http://www.eureta.org

Profile: EurEta was established in 1993 to set formation standards for higher engineering and technical professionals across Europe. There are over 1600 EurEta registrants mainly from 6 European countries.

Mission/Activities: EurEta operates a register and its aims include securing recognition of the title EurEta registered Engineer (Ing. EurEta), facilitating the free movement of engineers, assuring mutual recognition, promoting the responsible practice of engineering, encouraging continuing professional development and international networking. Continuing professional development is a current target of high priority in the association.

Relation with LLL: Close

IGIP	**IGIP**	**International Society for Engineering Education**

Website: http://www.igip.info

Profile: Founded in 1972 (initially as an association), IGIP has today members, both individuals and organisations, from 72 countries and enjoys consultative status with UNESCO and UNIDO. The principal aims of the Society are to promote a scientific approach to engineering education (for all those active in engineering and technology, from skilled workers to graduate engineers) and to coordinate and support internationally those endeavours that further engineering education.

Mission/Activities: The mission of IGIP comprises: (a) improving teaching methods in technical subjects, (b) developing practice-oriented curricula, (c) encouraging the use of media in technical teaching, (d) integrating the humanities in engineering education, (e) fostering management training for engineers, (f) promoting environmental awareness etc. Ten Working Groups of the Society on various topics report on relevant activities of IGIP, which cover organisation of conferences and arranging state-of-the-art courses on issues in engineering education (including engineering pedagogy), establishment and maintenance of contacts with national and international communities of related interests, provision of information for the public about the nature, aims and possibilities of engineering education.

Relation with LLL: Close.

	EAEA	**European Association for the Education of Adults**

Website: http://www.eaea.org

Profile: Funded in 1953 (originally known as the “European Bureau of Adult Education”), EAEA is a European non-governmental organisation with almost 100 member organisations from 34 countries working in the fields of adult learning. EAEA is a service association beyond the present scope of its membership. Mainly through its website (updated every two days), it provides continuously updated information on European developments (e.g. legislation), policy papers, conference findings and key contributions in the field of LLL. Additionally, EAEA is linked with most of the relevant European and global players in the field of adult learning.

Mission/Activities: Its purpose is to link and represent European organisations which are directly involved in adult learning. The main roles of EAEA are: (a) policy advocacy for LLL at a European level, (b) development of practice through projects, publications and training, (c) provision of information and services for its members, and

(d) international cooperation. The activities of EAEA include: a) acting as an advocate for adult learning and for NGOs working in this field, (b) supporting its members and their networks, (c) developing thinking about the nature and importance of adult learning, (d) promoting shared learning, (e) organising information seminars and awareness raising activities about EU programmes and policy developments, (f) publishing newsletters and reports, and (g) cooperating with other organisations in pursuit of the aims of EAEA

Relation with LLL: Very strong.

	EFVET	**European Forum of Technical and Vocational Education and Training**

Website: http://www.efvet.org

Profile: EFVET is a European-wide professional association which has been created by and for providers of technical and vocational education and training in all European countries. Developed with the support of the European Commission and the European Institute of Education and Social Policy, EFVET is the only transnational organisation of this type (members come from 25 countries, out of which 18 are European). Its policy is determined by its members among which are technical and vocational education and training institutions in both the public and private sectors, national associations, consortia of colleges and schools, validating bodies, companies with training departments and individuals.

Mission/Activities: The mission of EFVET is to champion and enrich technical and vocational education and training through transnational cooperation by building a pan-European network of institutions and practitioners which: (a) promote quality and innovation in technical and vocational education and training throughout Europe, (b) develop collaboration, mutual cooperation and sharing of good practice, and (c) give colleges a platform of influence in European technical and vocational education and training. Activities/services to members of EFVET include a European Information Bulletin, an EFVET Newsletter, opportunities of participating in special technical assistance projects (e.g. with developing countries), individual partnership finding service and access to experts, organisation of seminars and workshops etc.

Relation with LLL: Strong.

Networks

	EUCEN	**European University Continuing Education Network**

Website: http://www.eucen.org

Profile: Having started its work in 1991, EUCEN has been registered in 1992 in Belgium as an international non-governmental and non-profit association of universities (institutional membership) which are concerned with the development of continuing education in Europe. To date EUCEN is considered the largest European multidisciplinary network in university continuing education, having 189 members from 38 countries in western, central and eastern Europe. One of the major points of interest regarding the important role of EUCEN is the policy making process is its active involvement in projects and networking activities, some of which are quite related to the subject of the report at hand (e.g. see below THENUCE, EQUIPE, TRANSFINE and ALPINE).

Mission/Activities: The mission of EUCEN is: (a) to enable the exchange of experience and information between members on current continuing education regulations and policies and establish contacts with the relevant European bodies, (b) provide contacts for members with continuing education policy makers and practitioners in a range of universities throughout Europe, (c) seek to harmonise levels of quality for UCE among members and to maintain standards for effective monitoring, (d) contribute to the development of an effective university credit transfer system that would be acceptable within the network, and (e) seek to influence European policy on university continuing education. The strategy of EUCEN to achieve its mission includes various actions and activities, such as: (a) assist university continuing education policy makers in selecting the most appropriate and effective policies for their own institutions, (b) provide a forum for discussion of ideas as well as a source of information to members, (c) help members to strengthen their contacts with employers and the professions in European countries, (d) provide academic and administrative support with members working together to expand their continuing education, and (e) provide opportunities for continuing education staff development through staff exchange etc.

Relation with LLL: Very strong.

EVTA	**EVTA**	**European Vocational Training Association**

Website: http://www.evta.net

Profile: EVTA is a vocational training network comprised of 15 members from 14 European countries, representing national training and, in certain cases, national employment services. EVTA's members reflect different national approaches to vocational training as they are centralised or decentralised, public or private and are either dedicated to vocational training only or integrating vocational training and employment services. EVTA's members manage approximately 1500 regional and local training centers employ 50,000 trainers, psychologists and advisors and train over 1,000,000 people per year.

Mission/Activities: EVTA has been developed as a pan-European network to promote and to contribute to the European vision of vocational training in the 21st century by: (a) creating a permanent laboratory to conceive, develop and test new training methods, procedures and concepts, (b) creating synergies and sharing expertise and knowledge in vocational training, (c) promoting the principle of pan-European training resources and vocational training mobility, (d) bringing closer training and education and promoting them as a lifelong process for employment, self-esteem and personal satisfaction of people of all ages, and (e) promoting the adaptability of the European citizen to changing labour markets. The major activity of EVTA today is the development within a platform ("Cutting the Diamond") of six main themes. One of them ("Facilitating Lifelong Learning: tools, methods and infrastructure") has been already reported and is of direct relation to the subject of the report at hand.

Relation with LLL: Very strong.

Projects

H3E	**H3E**	**Higher Engineering Education for Europe**

Website: http://www.hut.fi/Misc/H3E

Profile: H3E was the first SOCRATES Thematic Network involved exclusively in matters of higher engineering education in Europe. The partner organisations in this project that finished in 1999 were SEFI, CESAER and BEST (Board of European Students of Technology). In fact H3E is considered to be a pioneer project that paved the way of studying the whole array of important issues and also produced a number of innovative reports on engineering education, which subsequent similar networks (like E4 and TREE) used as handy inputs in their relevant discussions.

Mission/Activities: The overall aim of H3E was to contribute to the development of a European dimension within higher engineering education through reflections and actions. Its work was carried out in order to: (a) put forward the common elements that exist across European higher engineering education systems in six main issues (i.e. motivation for higher engineering studies; types and forms of higher engineering education and core curricula; quality assurance and mutual recognition; internationalisation; educational methods to foster LLL; continuing education), (b) act in favour of a coordinated approach in facing the challenges in all these issues, and (c) support specific case studies likely to bring added value and enrich the work carried out in connection with points above. Among the work produced by the Working Groups of H3E the most important outcome in relation with LLL is the report "Lifelong Learning in Engineering Education: A Call to Action".

Relation with LLL: Strong

	E4	**Enhancing Engineering Education in Europe**

Website: http://www.unifi.it/tne4

Profile: E4 was a SOCRATES Thematic Network dedicated to engineering education that began in 2000 and concluded its very comprehensive activities quite recently, in 2004. A really multinational teamwork, with its headquarters based at Universita degli Studi di Firenze in Italy, E4 involved 103 partner institutions and organisations from 27 European countries and encompassed all branches of engineering.

Mission/Activities: E4's overall goal was to develop the European dimension of Engineering education by enhancing the compatibility of the many diverse routes to the profession of engineer, by facilitating greater mobility and integration of skilled personnel throughout Europe, by favouring a mutual exchange of skills and competences and providing a platform for communication between academics and professionals. The main activities of E4 included: (a) employability through innovative curricula, (b) quality assessment and transparency for enhanced mobility and trans-European recognition, (c) engineering professional development for Europe, (d) enhancing the European dimension, and (e) innovative learning and teaching methods. The network has published its entire outcome in a 7-volume box that contains the results of the above activities plus a "Glossary of Terms Relevant for Engineering Education".

Relation with LLL: Very close

	TREE	**Teaching and Research in Engineering in Europe**

Website: http://www3.unifi.it/tree

Profile: TREE, a SOCRATES Thematic Network project, is a direct continuation of E4 and began its operation in early 2005. As a consequence the overall goal is exactly the same with E4. Still the particular aim of TREE is to shift between a study phase (like that of E4) and a more project-oriented phase, which means that the results of E4 constitute the starting point of TREE activities.

Mission/Activities: In order to be successful, this new Thematic Network in engineering education will blend study activities, forum organisation and pioneering exercises, keeping as main target the production of all sorts of tools for enhancing the European dimension. The activity of TREE will be developed along four main lines: (a) the *tuning* line (new curricula for the two-tier structure of higher education, tools for quality assessment and assurance, accreditation, extension of ECTS, adoption of the methodology of the TUNING project), (b) the *education and research* line (status and promotion of doctoral studies, role of research activity in engineering education, value of research oriented project work), (c) the *attractiveness of engineering education* line (for young people, especially women, for extra-EU students, by special initiatives such as double degrees), and (d) the *sustainability* line (sustain engineering education institutions by, e.g. developing continuing education, and/or open and distant learning opportunities etc.).

Relation with LLL: Close

CEE as WBL	**CEE as WBL**	**Continuing Engineering Education as Work Based Learning**

Website: http://www.elite.aau.dk/cee_as_wbl

Profile: A Leonardo da Vinci Programme, running for a period of 2 years (from October 2003), has the Aalborg University (Denmark) as the contractor and 7 other universities from an equal number of countries as partner institutions. On the background of a research-based university-industry cooperation, this project will develop models and methods for the establishment of *work-based learning* (WBL).

Mission/Activities: Tools for continuous maintenance and improvement of professional competences among employees in a given enterprise will be developed, and the project will contribute with research concerning pedagogical and didactic methods for facilitation of the continuing learning process at university level in the industry. Test studies will be carried in 3 different European countries with different spheres of focus, and the WBL-management practices will be elaborated further. Finally, as a major issue in the dissemination phases a book on WBL will be published.

Relation with LLL: Very strong

	THENUCE	**Thematic Network Project in European University Continuing Education**

Website: http://www.fe.up.pt/nuce

Profile: This Thematic Network Project, funded under the SOCRATES Programme for the years 1996-2000, was proposed and led by EUCEN with the aim to examine the European dimension of university continuing education and to address cross-disciplinary and administrative issues of common interest for cooperation. 19 European countries were represented in the project by various institutions totaling a number of about 120 partners.

Mission/Activities: The project was designed and implemented to have a lasting and widespread impact on the development and management of continuing education programmes so that it could regarded as a key instrument for the enhancement of academic quality in this area. During the 3 academic years 1996-1997, 1997-1998 and 1998-1999 THENUCE produced various kinds of output, including National Reports from 19 European countries and a European Report as well as results from numerous investigated subjects by its 14 Working Groups and 6 Task Forces. The final academic year 1999-2000 was devoted to the dissemination of the project. THENUCE+ Project is an international project which started in 2000 and presents the follow-up THENUCE. This project is coordinated by the University of Liege (Belgium) with more than 140 partner institutions from 28 countries involved in it.

Relation with LLL: Very strong

	TRANSFINE	**Transfer between Formal, Informal and Non-Formal Education**

Website: http://www.univ-lille1.fr/transfine

Profile: TRANSFINE was a joint action project that began in May 2002 and finished in July 2003 (contractor: University of Lille). It led to the TRANSFINE Partnership, built around an inner cycle of 5 European networks covering the fields of Socrates, Leonardo and Youth: EUCEN (lead partner), EAEA, FIEEA, AEFP (EVTA) and SEFI.

Mission/Activities: The objectives of the project were: (a) to collect, analyse and build on work already carried out at national and EU level in the 3 programme areas and across formal, informal and non-formal education, (b) to investigate the feasibility of an integrated set of procedures for a system of transfer and accumulation of qualifications, (c) to create, develop and propose the principles, methods and tools for such a system, and (d) and to construct a specification for pilot projects to test the proposals. The main output of the project is its Final Report, a text of about 60 pages long.

Relation with LLL: Strong

	ALPINE	**Adults Learning and Participation in Education**

Website: http://www.qub.ac.uk/alpine

Profile: The project, which began in 2001 and finished in 2004, had 34 members from 31 universities, one adult education association and one co-ordinating body for adult education (lead partner: Institute of Lifelong Learning, Queen's University Belfast, Northern Ireland). 20 European countries were represented in the project. ALPINE set out to examine current practice in the provision of education of adult in European universities, the barriers that exist for adults who wish to enter higher education and ways of overcoming these barriers.

Mission/Activities: ALPINE main aims included: (a) to examine how universities are meeting the needs of adults, the challenge of equal opportunities, what kind of training and development is available for staff, and the kind of curriculum which adults might want, (b) to enable universities throughout Europe to review and improve their provision, to widen access and to increase overall adult student numbers significantly, and (c) to identify examples of good practice in participating countries. A number of working groups elaborated various subjects, the most prestige of their output being a book on "Adult Education in European Universities" and an "E-manual of Good Practice".

Relation with LLL: Very strong

European University Lifelong Learning Network EULLearN	**EULLEARN**	**European University Lifelong Learning Network**

Website: http://www.eullearn.net

Profile: EULLearN is a cross-disciplinary European Thematic Network project that is currently under operation and aspires to identify coherent strategies and practical measures to foster university LLL. The 87 targeted EULLearN partner institutions in 31 countries aim, with the support of Socrates, at more cohesive and economical use of existing instruments and resources.

Mission/Activities: EULLearN supports the exchange of good practices and experiences and the identification of common problems, ideas and priorities through the work of three Targeted Thematic Groups (TTG): TTG A – LLL Methods and Environments, Common Core References, Lifelong Learning Materials. TTG B – National University Lifelong Learning Networks and European Co-operation. TTG C – Accreditation in LLL, Tuning ("Developing agreement and harmony in LLL structures"), APEL ("Accreditation of Prior Experimental Learning) and ECATS ("European Credit Accumulation & Transfer Systems") in LLL. This specific project draws material and relates closely with similar projects like THENUCE and ALPINE.

Relation with LLL: Very strong

EQUIPE	**EQUIPE**	**European Quality in Individualised Pathways in Education**

Website: http://equipe.up.pt

Profile: The EQUIPE project was launched in October 2002 (funded by SOCRATES Grundtvig for duration of 36 months) to give expert practitioners and managers of EUCEN's member universities the opportunity to collaborate to enhance the quality of individualised learning pathways for adults in higher education. EQUIPE brings together 28 European institutions and 4 major European networks to develop and publish a web-based toolkit that is intended to support quality projects in university adult learning, highlighting and focusing on new forms of practice. In this way EQUIPE aims at increasing confidence in and encouraging innovative educational practices in LLL in universities everywhere.

Mission/Activities: In addition to the above, the project aims at enhancing the quality of the educational practices in relation to: access and entry issues (e.g. the learning contract, APEL, advice, guidance, orientation), the learning experience at university (e.g. courses, projects, ODL and e-learning, tutorial, support, certification), and impact and progression (e.g student satisfaction, personal and professional impact, social and community development). Apart from the development of the toolkit, other operational objectives comprise: to review existing models and approaches to quality assurance; to deliver a range of staff development activities in seminars, conferences, and workshops; to exploit the expertise of various experts, partners and networks in order to build capacity in European universities in relation to quality, university adult learning and the new publics for higher level study.

Relation with LLL: Very strong

ANNEX B

A.1 Bulgaria

Institution	Website or e-mail address
Bulgarian Scientific and Technical Unit of Civil Engineering	ntss@mail.bg
University of Architecture, Civil Engineering and Geodesy – Sofia	http://www.uacg.bg
Varna Free University –Varna	http://www.vfu.bg
Higher School of Transport – Sofia	http://www.vtu.bg

A.2 Cyprus

Institution	Website or e-mail address
Technical Chamber of Cyprus	http://www.etek.org.cy

A.3 Czech Republic

Institution	Website or e-mail address
Czech Chamber of Chartered Engineers and Technicians	http://www.ckait.cz
Czech Association of Civil Engineers	http://www.cssi-cz.cz
STUDIO AXIS, spol. s.r.o. - Prague	http://www.studioaxis.cz
ABF - Foundation for Architecture and Civil Engineering development	http://www.abf.cz/nadace
PSM CZ, s.r.o. - Prague	http://www.psmcz.cz
SEKURKON – AE – Prague	http://www.sekurkon.cz
XANADU, s.r.o.	http://www.xanadu.cz
Technical University of Ostrava - Ostrava	http://www.vsb.cz
University of Pardubice - Pardubice	http://www.upce.cz
Czech Technical University - Prague	http://www.fsv.cvut.cz
Brno University of Technology - Brno	http://www.fce.vutbr.cz

A.4 Denmark

Institution	Website or e-mail address
DIEU - Danish engineers' continuing education	http://www.dieu.com
IDA - The Danish Society of Engineers	http:// www.ida.dk
FRI - The Danish Association of Consulting Engineers	http:// www.frinet.dk
TL - Teknisk Landsforbund	http://www.tl.dk
Dansk Byggeri - Danish Construction Association	http:// www.danskbyggeri.dk
Technical University of Denmark - Lyngby	http:// www.dtu.dk
Aalborg University - Aalborg	http://www.auc.dk
Copenhagen University College of Engineering - Copenhagen	http://www.ihk.dk
University College of Aarhus - Aarhus	http://www.iha.dk

Odense University College of Engineering	http://www.iot.dk
Vitus Bering Danmark	http:// www.vitusbering.dk
Herning Institute of Business Administration and Technology	http://www.hih.dk

A.5 France

Institution	**Website or e-mail address**
Conservatoire National des Arts et Métiers	http://www.cnam.fr
CUST - Campus Universitaire des Cézeaux	http://cust.univ-bpclermont.fr
Ecole des Mines d'Alès	http://www.ema.fr/
Ecole des Mines de Douai	http://www.ensm-douai.fr
Ecole Nationale des Ponts et Chaussées	http://pfe.enpc.fr/
École Normale Supérieure de Cachan	http://www.fcd.ens-cachan.fr
ENISE	http://www.enise.fr
ENSAM	http://www.paris.ensam.fr
ENSG - Bât. E	http://www.ensg.inpl-nancy.fr
ENTPE	http://www.cge.asso.fr
ESTP - Formation continue	http://www.estp.fr
Conservatoire National des Arts et Métiers	http://www.cnam.fr
INPG	http://formation-continue.inpg.fr
INSA - Lyon	http://www.insa-lyon.fr
INSA - Strasbourg	http://www.insa-strasbourg.fr
INSA - Toulouse	http://www.insa-toulouse.fr
Institut Supérieur du Bâtiment et des Travaux Publics	http://www.isba.fr/isba
ITII Ile-de-France	http://www.cesfa-btp.com
ITII Nantes	http://www.itii-pdl.com
Pôle Universitaire Européen de Toulouse	http://www.pole-tlse.fr
Polytech'Grenoble	http://polytech.ujf-grenoble.fr
Polytech'Lille	http://www.polytech-lille.fr
Polytech'Orléans	http://www.univ-orleans.fr
Université Angers	http://www.univ-angers.fr
Université Bordeaux 1	http://www.u-bordeaux1.fr
Université Claude Bernard LYON 1	http://iuta.univ-lyon1.fr
Université d'Angers	http://www.univ-angers.fr
Université d'Artois	http://www.univ-artois.fr
Université de Bretagne Sud	http://www.univ-ubs.fr
Université de Cergy-Pontoise	http://www.u-cergy.fr
Université de Greonble - IUT Grenoble	http://www-iut.ujf-grenoble.fr
Université de Nantes	http://www.univ-nantes.fr
Université de Rennes I	http://sfc.univ-rennes1.fr
Université de Toulouse-Le Mirail	http://www.univ-tlse2.fr
Université Marne-la-Vallee	http://www.univ-mlv.fr
Université Metz	http://www.mim.univ-metz.fr
Université Montpellier II	http://www.univ-montp2.fr
Université Montpellier II	http://www.iut-nimes.fr

Université Paul Sabatier	http://mfca.ups-tlse.fr
Université Toulouse3	http://www.ups-tlse.fr

A.6 Finland

Institution	Website or e-mail address
Association of Finnish Civil Engineers	http://www.ril.fi
Lifelong Learning Institute Dipoli - Espoo	http://www.dipoli.tkk.fi
Helsinki University of Technology - Espoo	http://www.tkk.fi
Tampere University of Technology - Tampere	http://www.tut.fi

A.7 Germany

No list available

A.8 Greece

Institution	Website or e-mail address
Technical Chamber of Greece	http://www.tee.gr
Hellenic Open University	http://www.eap.gr
National Technical University of Athens	http://www.ntua.gr
Hellenic Centre of Information and Training	http://www.ekpe.gr

A.9 Hungary

Institution	Website or e-mail address
Hungarian Chamber of Engineers	http://www.mmk.hu
Hungarian Ministry of Education	http://www.om.hu
Budapest University of Technology and Economics - Budapest	http://www.bme.hu
University of Debrecen - Debrecen	http://www.unideb.hu
University of Pécs - Pécs	http://www.pte.hu
Széchenyi István University - Győr	http://www.sze.hu
Szent István University - Gödöllő	http://www.szie.hu

A.10 Norway

Institution	Website or e-mail address
Norwegian Society of Chartered Technical and Scientific Professionals	http://www.tekna.no
Norwegian Institute of Science and Technology - Trondheim	http://www.ntnu.no
University of Stavanger - Stavanger	http://www.uis.no
University of Oslo - Oslo	http://www.uio.no
Norwegian University of Life Sciences - Aas	http://www.umb.no
Narvik University College - Narvik	http://www.hin.no
Sor-Trondelag University College -Trondheim	http://www.hist.no

A.11 Poland

Institution	Website or e-mail address
Roads and Bridges Institute - Warsaw	http://www.ibdim.edu.pl
Bialystok Technical University - Bialystok	http://www.pb.bialystok.pl
Lodz Technical University - Lodz	http://www.p.lodz.pl
Rzeszow Technical University - Rzeszow	http://www.prz.rzeszow.pl
Szczecin Technical University - Szczecin	http://www.tuniv.szczecin.pl
Warsaw University of Technology - Warsaw	http://www.pw.edu.pl
Wroclaw Technical University - Wroclaw	http://www.pwr.wroc.pl

A.12 Portugal

Institution	Website or e-mail address
FUNDEC (Foundation for the Continuing Education in Civil Engineering)	http://www.civil.ist.utl.pt/fundec
Faculty of Engineering University of Porto - Porto	http://www.fe.up.pt
University of Minho - Minho	http://www.uminho.pt

A.13 Romania

Institution	Website or e-mail address
Ion Mincu University of Architecture and Urbanism – Bucharest	http://www.iaim.ro
Transilvania University of Brasov – Brasov	http://www.unitbv.ro
Politehnica University of Timisoara	http://www.utt.ro
Technical University of Cluj-Napoca	http://www.utcluj.ro
Technical University Iasi	http://www.tuiaci.ro
Technical University of Constructions - Bucharest	http://www.utcb.ro
Ovidius University - Constanta	http://www.univ-ovidius.ro

A.14 Russia

Institution	Website or e-mail address
Moscow State University of Civil Engineering – Moscow	http://www.mgsu.ru
Rostov-on-Don State University of Civil Engineering	
Nizhniy Novgorod State University of Architecture and Civil Engineering	
Samara State University of Architecture and Civil Engineering	
Volgograd State University of Architecture and Civil Engineering	
Voronezh State University of Architecture and Civil Engineering	rady@vgasu.vrn.ru
Kazan State University of Architecture and Civil Engineering	

Novosibirsk State University of Architecture and Civil Engineering	
Penza State University of Architecture and Civil Engineering	
Tomsk State University of Architecture and Civil Engineering	
Ivanovo State Academy of Architecture and Civil Engineering	
Krasnoyarsk State Academy of Architecture and Civil Engineering	
Tyumen State Academy of Architecture and Civil Engineering	
Moscow Institute of Municipal Economy and Civil Engineering	
Belgorod State University of Technology	

A.15 Slovakia

Institution	Website or e-mail address
STU - Bratislava	http://www.sfv.stuba.sk
University of Žilina	http://www.svf.utc.sk

A.16 Spain

No list available

A.17 Turkey

Institution	Website or e-mail address
Turkish Chamber of Civil Engineers	http://www.imo.org
General Directorate of State Waterworks	http://www.dsi.gov.tr
General Directorate of State Highways	http://www.kgm.gov.tr
Istanbul Technical University – Istanbul: Continuing Education Centre	http://www.itu.edu.tr
Gazi University – Ankara: Continuing Education Centre	http://www.gazi.edu.tr
Middle East Technical University – Ankara: Continuing Education Centre	http://www.metu.edu.tr
Izmir Institute of Technology – Izmir: Centre for Continuing Education	http://www.iztech.edu.tr
Anadolu University – Eskisehir: Distance Education Open Faculty	http://www.anadolu.edu.tr

A.18 United Kingdom

No list available