INQUIRIES INTO EUROPEAN HIGHER EDUCATION IN CIVIL ENGINEERING

LIFELONG LEARNING - ERASMUS
THEMATIC NETWORK PROJECT

EUROPEAN CIVIL ENGINEERING EDUCATION AND TRAINING

SEVENTH EUCEET VOLUME

Edited by
Iacint Manoliu

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FOREWORD

This is the seventh 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 Lifelong Learning programme.

The volume comprises the Reports of the Working Groups pertaining to three, out of the total of eight, themes undertaken under EUCEET III:

- Theme A: "*Implementation of the two-tier study programmes in civil engineering education across Europe, following the Bologna process*" (Chairman of the Working Group: Professor Iacint Manoliu, Technical University of Civil Engineering of Bucharest, Romania).
- Theme B: "*Enhancement of the cooperation between civil engineering faculties in Europe by the development of joint degrees*" (Chairman of the Working Group: Professor Radu Bancila, University "Politehnica" Timisoara, Romania).
- Theme D: "*Best practice in establishing and running multi-disciplinary programmes of education, involving civil engineering and other fields*" (Chairman of the Working Group: Professor Tudor Bugnariu, Technical University of Civil Engineering of Bucharest, Romania).

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

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Professor Iacint MANOLIU

Chairman of EUCEET III
Management Committee

ABOUT THE EDITOR

Iacint MANOLIU is Professor of Geotechnical Engineering at the Technical University of Civil Engineering in Bucharest. He spent one year (1968) as a Fulbright scholar at the University of Texas at Austin. Served as Vice-Dean of the Faculty of Civil, Industrial & Agricultural Buildings between 1972 – 1976 and as Dean of the same Faculty between 1976 – 1984. Between 1990 and 2000 was Vice-Rector for Academic and International Affairs of the TUCEB. Presently is President of the Council for Cooperation and Relations of the University. Was Secretary General of the Steering Committee of the Thematic Network Project EUCEET I and Chairman of the Management Committee for Projects EUCEET II and EUCEET III. Following the 1st General Assembly of the EUCEET Association (Warsaw, 24 October 2008), was designated as General Secretary of the Association.

Prof. Iacint MANOLIU is President of the Romanian Geotechnical Society, Vice-President of the Union of Associations of Civil Engineers of Romania and Chairman of the Standing Committee on Education & Training of ECCE (European Council of Civil Engineers).

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THEME A: IMPLEMENTATION OF THE TWO-TIER STUDY PROGRAMME IN CIVIL ENGINEERING EDUCATION ACROSS EUROPE, FOLLOWING THE BOLOGNA PROCESS

Report of Working Group
Iacint MANOLIU[1]

1. BACKGROUND

The Full Proposal for the Thematic Network Project EUCEET III stated the followings in support of the Theme A.

"The starting moment for EUCEET I was October 1st, 1998. Admitting that what is commonly named Bologna process was in fact triggered in May 1998 in Sorbonne, by the Joint Declaration of 4 ministers of education (FR, UK, DE, IT) "on the harmonization of the architecture of the European higher education system*", one can realize that the life so far of EUCEET coincided almost perfectly with the Bologna process. As it is known, the action line which implies important changes in the structure of university studies in Europe is the action line 2 of the Bologna Declaration, calling for the "*adoption of a system essentially based on two main cycles, undergraduate and graduate*".

EUCEET produced a large number of reports directly related to curricula matters which, as a result, brought an important support to partner universities in making the changes required by the Bologna process. At the same time, the Management Committee of EUCEET adopted in February 2004 a "Position statement on the implementation of the Bologna Declaration in civil engineering education", which was also very helpful, particularly in the transition from the "integrated programmes" (5-year duration, leading straight to second cycle degree) to the "two-tier programmes". Now that, with very few exceptions, this transition becomes effective, it is the moment to assess various solutions which have been adopted, to underscore problems which occurred and to define lines for future action.

Activities under the theme "A" will have in view both first cycle and second cycle degree programmes."

Considering the commitment expressed in the Full Proposal, the Terms of Reference defined for the Working Group A a number of tasks, such as:

- To undertake a survey among partners in the Project in order to obtain a picture as clear and complete as possible about the present situation in the

[1] Chairman of the Working Group for the Theme A;
Prof. Dr. at Technical University of Civil Engineering Bucharest, Romania

systems of education in various countries with relevance for Civil Engineering education, namely to obtain answers to the following questions:
  - if a transition from the integrated programmes to two-tier programmes was implemented and when
  - what was the solution adopted for the transition;
  - in situations when the transition did not yet took place, if it is anticipated that it will take place, when and which solution is likely to be adopted;
  - which are the main provisions of the law or other regulatory document which triggered the transition
- To collect data on the approaches used for building the new study programme for the first cycle
- To get from the universities where already there are graduates of the first cycle in the new two-tier system, an evaluation of the results and of the problems encountered and, also, data on the number of graduates which continued straight for the second cycle
- To promote and encourage the exchange of experience between universities which adopted the same or very similar solution when shifting from the integrated programmes to two-tier programmes
- To investigate the content of the second cycle (Master) programmes
- To asses, in cooperation with the Standing Committee on Education and Training of the European Council of Civil Engineers reaction of the professional world to the changes introduced by the Bologna process, with emphasis on the employability of the graduates of the new first cycle programmes.

2. SUMMARY OF THE ACTIVITY OF THE WORKING GROUP FOR THE THEME A

Following the first EUCEET III Management Committee which took place in Vilnius, on 8 December 2006, an inquiry was under taken among partners to establish the composition of the Working Groups for the themes to be launched at the 1st EUCEET III General Assembly to be held in 15 – 16 March 2007 in Santander.

The Chairman of the Working Group A received the following adhesions:

Jean Thimus	Université Catholique Louvain	BE
Gospodin Gospodinov	University of Architecture, Civil Engineers and Geodesy Sofia	BG
Vaclav Kuraz	Czech Technical Univeristy	CZ
Vladimir Delezal	University Pardubice	CZ

Petr Stepanek	Brno University of Technology	CZ
Alois Materna	Ostrava University of Technology	CZ
Andrés Valiente Cancho	Universidad Politecnica Madrid	ES
Benjamin Suarez	Universidad Politecnica de Catalunya	ES
Richard Kastner	Institute National of Applied Sciences Lyon	FR
Antal Lovas	Budapest University of Technology and Economics	HU
Aniko Csebfalvi	Janus Pannonius University Pecs	HU
William Magette	University College of Dublin	IE
Franco Maceri	University of Roma Tor Vergata	IT
Luca Facchini	University of Florence	IT
Diego Lo Presti	University of Pisa	IT
Nijole Kikutiene	Lithuanian Association of Civil Engineers	LT
Dion Buhagiar	University of Malta	MT
Szczepan Wolinski	Rzeszow University of Technology	PL
Piotr Berkowski	Wroclaw University of Technology	PL
Andrzej Lapko	Bialystok Politechnika	PL
Ryszard Kowalczyk	University of Beira Interior Covilha	PT
Miroslav Premrov	University of Maribor	SI
Matej Fischinger	University of Ljubljana	SI
Jozef Dicky	Slovak University of Technology Bratislava	SK
Josef Vican	University of Zilina	SK
Mohammed Raoof	Loughborough University	UK
David Lloyd Smith	Imperial College of Science, Technology and Medicine	
Ian May	Heriot - Watt University	UK
Nicolae Taranu Irina Lungu	"GH. ASACHI" Technical University Iasi	RO
Virgil Breaban	University OVIDIUS Constantza	RO
Radu Bancila	University Politehnica Timisoara	RO
Pavel Alexa	Technical University Cluj-Napoca	RO
Tudor Bugnariu	Technical University of Civil Engineers Bucharest	RO
Ilknur Bozbey	Istanbul University	TR

The Working Group A organized a "*Survey on the transition from the integrated 5-year programmes to two-tier programmes*", whose results were discussed at the meeting which took place on 15th March 2007 in Santander, attended by:

Jean Thimus	Université Catholique Louvain	BE
Jean Berlamont	Katholieke Universiteit Leuven	BE
Gospodin Gospodinov	Univ. of Architecture, Civil Engineers and Geodesy Sofia	BG
Vaclav Kuraz	Czech Technical University Prague	CZ
Alois Materna	Ostrava University of Technology	CZ
Carsten Ahrens	ZDI – Zentral Verband Deutsche Ingenieure	DE
Ulvi Arslan	Technical Univeristy Darmstadt	DE
Benjamin Suarez	Universidad Politecnica de Catalunya	ES
Richard Kastner	Institut National des Sciences Appliquées de Lyon	FR
Antal Lovas	Budapest University of Technology and Economics	HU
Brendan O'Kelly	University of Dublin Trinity College	IE
Diego Lo Presti	University of Pisa	IT
Piotr Berkowski	Wroclaw University of Technology	PL
Andrzej Lapko	Bialystok Politechnika	PL
Bento Leal Joeiro	University of Beira Interior Covilha	PT
Nicolae Taranu	"GH. ASACHI" Technical University Iasi	RO
Irina Lungu		
Radu Bancila	University Politehnica Timisoara	RO
Iacint Manoliu	Technical University of Civil Engineers Bucharest	RO
Jozef Dicky	Slovak University of Technology Bratislava	SK
Josef Vican	University of Zilina	SK
Mohammed Raoof	Loughborough University	UK
David Lloyd Smith	Imperial College of Science, Technology and Medicine	
Ian May	Heriot - Watt University	UK

Core members of the Working Group A, invited by the Chairman, prepared contributions for the Workshop "*The new first cycle degree programmes in civil engineering in Europe – problems and solutions*" which was included in the programme of the 1st EUCEET III General Assembly in Santander and was attended, on 16th March 2007 by all the participants to the General Assembly.

Members of the Working Group A, professors of Geotechnical engineering, took an active role in the Workshop on the "*Bologna process and its impact on the education in geo-engineering sciences in Europe*" which took place in Constantza on 2 – 3 June 2008.

According to the workplan established in Santander and in view of the 2nd EUCEET III General Assembly, Working Group A organized a "*Survey on civil engineering master programmes*". The results of the survey formed a distinct

part of the Report on theme A which was discussed at the meeting of the Working Group which took place on 23rd October 2008 in Warsaw and was attended by:

Nicos Neocleous	Cyprus Civil Engineers Association	CY
Ulvi Arslan	Technical University Darmstadt	DE
Jesus J. Granero Megias	Colegio de Ingenieros de Caminos, Canales y Puertos Madrid	ES
Pedro Rodriguez Herranz	Colegio de Ingenieros de Caminos, Canales y Puertos Madrid	ES
Richard Kastner	Institut National des Sciences Appliquées de Lyon	FR
Bernard Le Tallec	Institut Superieur du Batiment et des Travaux Public Marseille	FR
Aris Avdelas	Aristotele University of Thessaloniki	GR
Stephanos Dritsos	University of Petras	GR
Aniko Csebfalvi	Janus Pannonius University Pecs	HU
Antal Lovas	Budapest University of Technology and Economics	HU
Jozsef Mecsi	Janus Pannonius University Pecs	HU
William Magette	University College Dublin	IE
Brendan O'Kelly	Trinity College Dublin	IE
Luca Deseri	University of Trento	IT
Federico Perotti	Politecnico di Milano	IT
Vincentas Stragys	Vilnius Gediminas Technical University	LT
Ellen Touw	Delft University of Technology of Netherlands	NL
Piotr Berkowski	Wroclaw University of Technology	PL
Magdalena Brzozowska	Opole University of Technology	PL
Andrzej Łapko	Białystok Technical University	PL
Andrzej Minasowicz	Warsaw University of Technology	PL
Fernando Branco	Technical University of Lisbon	PT
Ryszard Kowalczyk	University of Beira Interior Covilha	PT
Alfredo Soeiro	University of Porto	PT
Tudor Bugnariu	Technical University of Civil Engineering Bucharest	RO
Vasilica Dima	PROCEMA Bucharest	RO
Iacint Manoliu	Technical University of Civil Engineering Bucharest	RO
Doina Verdes	Technical University of Cluj-Napoca	RO
Goran Turk	University of Ljubljana	SI
Jozef Dicky	Slovak University of Technology Bratislava	SK
Josef Vican	University of Zilina	SK

Turgul Tankut	Turkish Chamber of Civil Engineers	TU
Laurie Boswell	City University London	UK
Alan Kwan	Cardiff University	UK
David Lloyd Smith	Imperial College London	UK
Ian May	Heriot Watt University Edinburgh	UK

The Report was then presented in the plenary session attended by all participants to the 2nd EUCEET III General Assembly.

The report presented in Warsaw marked the completion of the activities of the Working Group A.

3. THE TRANSITION FROM THE INTEGRATED 5-YEAR PROGRAMMES TO TWO-TIER PROGRAMMES

In preparation for the first EUCEET III General Assembly held in Santander on 15 – 16 March 2007, the Working Group for the Theme A launched a survey on the transition from the 5-year integrated programmes, to which 26 partners responded. In Santander it was decided to complete the questionnaire and to repeat the survey. This time 45 answers were received, out of a total of 75 academic partners in EUCEET III.

In what follows, a short review of the questions and answers obtained at the second survey is made.

Question: ***"Is the transition from integrated programme (5 or 6 year programmes) to two-tier programmes under way or already completed in your institution?"*** **- 42 answers received**

29 YES

BE Katholieke Universiteit Leuven
BE Université Catholique de Louvain
CZ Czech Technical University in Prague
DE Fachhochschule Oldenburg
DE Technical University München
DK Technical University of Denmark, Lingby
FI Helsinki University of Technology
FR Université Claude Bernard Lyon 1
FR University of Nantes
FR Institut Supérieur du Bâtiment et des Travaux Publics Marseille
HU Budapest University of Technology and Economics
IT Politecnico di Milano
LT Vilnius Gediminas Technical University
LT Riga Technical University

NL Delft University of Technology
PL Warsaw University of Technology
PT University of Beira Interior Covilha
PT Instituto Superior Técnico Lisbon
PT Universidade do Porto
RO Technical University "Gh. Asachi" Iasi
RO Technical University Cluj-Napoca
RO Technical University of Civil Engineering Bucharest
SE Chalmers University of Technology
SI University of Maribor
SK Slovak University of Technology in Bratislava
SK University of Zilina
TR Istanbul University
UK City University London
UK Cardiff University

13 NO

DE Technical University Dresden
EE Tallinn University of Technology
ES Universidade da Coruña
ES Universidad Politecnica de Madrid
FR Institut National des Sciences Apliquées INSA Lyon
FR Ecole Spéciale des Travaux Publics, du Bâtiment et de l'industrie, Paris
GR University of Patras
GR National Technical University Athens
PL Rzeszow University of Technology
SI University of Ljubljana
UK Imperial College London
GR Technological Education Institute of Serres
UK Loughborough University

Peculiarities in answers coming from UK

- Prof. Alan Kwan from Cardiff University specified:

"*In the UK, up to about 1987 we had 3yr BEng(Hons) and from about 1987 onwards, we have had 3yr BEng(Hons) and 4yr MEng(Hons). Before 1987, and now, we have also had 1 yr (12 study months) MSc courses, which students take after their BEng or MEng. Additionally, some institutions can have an additional "sandwich" year (a yr in industry) or a year in continental Europe which may or may not contribute to the degree. No UK institution (to my knowledge) has had any change to this structure since 1987, except that there are indications that one or two Civil Engineering schools are thinking of having*

an additional summer component to the MEng. The UK views the BEng/MEng structure as "Bologna compliant."

- Professor Mohammed Raoof from Loughborough University, UK, specified:

"*We did not have 5/6 year Programs. UK always had 3 year Bachelor+ 1 year Masters or 4 year Integrated MEng*."

- Prof. Ian May from Heriot Watt University, UK specified:

"*We didn't have a five or six year degree but moved straight from 4 years to a 4 year BEng degree and a 5 year MEng degree. We also have the possibility of supplementing the 4 year BEng degree with a 1 year MSc degree."*

Question: "***If the transition did not yet occur, it is expected to take place in the future and when"?*** **- 12 answers received**

5 YES

SI	University of Ljubljana	YES
ES	Universidad Politecnica de Madrid	YES in 2009
PL	Rzeszow University of Technology	YES in 2007/2008
ES	Universidade da Coruña	YES in 2010
PT	University of Beira Interior Covilha	YES, in 2007

7 NO

DE Technical University Dresden
FR Ecole Spéciale des Travaux Publics, du Bâtiment et de l'Industrie, Paris
GR University of Patras
GR National Technical University Athens
UK Imperial College London
UK Loughborough University
GR Technological Education Institute of Serres Serres

Question ***"On which base was undertaken the transition triggered by the Bologna process?"***

- **Law at national level: 18 answers**

LT Riga Technical University
EE Tallinn University of Technology

SI	University of Ljubljana
ES	Universidad Politecnica de Madrid
ES	Universidade da Coruña
CZ	Czech Technical University in Prague
DE	Fachhochschule Oldenburg
FR	Université Claude Bernard Lyon 1
HU	Budapest University of Technology and Economics
IT	Politecnico di Milano
NL	Delft University of Technology
PT	Universidade do Porto
RO	Technical University "Gh. Asachi" Iasi
RO	Technical University Cluj-Napoca
RO	Technical University of Civil Engineering Bucharest
SK	Slovak University of Technology in Bratislava
SK	University of Zilina
IT	University of Pisa

Decision of the Ministry of Education: 20 answers

LT	Riga Technical University
SI	University of Ljubljana
ES	Universidade da Coruña
DE	Fachhochschule Oldenburg
FR	Université Claude Bernard Lyon 1
HU	Budapest University of Technology and Economics
NL	Delft University of Technology
RO	Technical University Cluj-Napoca
RO	Technical University of Civil Engineering Bucharest
SK	Slovak University of Technology in Bratislava
LT	Vilnius Gediminas Technical University
PL	Rzeszow University of Technology
BE	Katholieke Universiteit Leuven
BE	Université Catholique de Louvain
DE	Technical University München
DK	Technical University of Denmark
FI	Helsinki University of Technology
PL	Warsaw University of Technology
SI	University of Maribor
PT	University of Beira Interior

- **Decision of the University Senate: 15 answers**

LT	Riga Technical University
DE	Fachhochschule Oldenburg
HU	Budapest University of Technology and Economics
RO	Technical University Cluj-Napoca
RO	Technical University of Civil Engineering Bucharest
SK	Slovak University of Technology in Bratislava
PL	Rzeszow University of Technology
DE	Technical University München
DK	Technical University of Denmark
PL	Warsaw University of Technology
SI	University of Maribor
CZ	Czech Technical University in Prague
FR	University of Nantes
PT	Instituto Superior Técnico Lisbon
SE	Chalmers University of Technology

- **Decision of the Faculty Council: 13 answers**

LT	Riga Technical University
DE	Fachhochschule Oldenburg
HU	Budapest University of Technology And Economics
RO	Technical University Cluj-Napoca
RO	Technical University of Civil Engineering Bucharest
SK	Slovak University of Technology in Bratislava
PL	Rzeszow University of Technology
DE	Technical University München
DK	Technical University of Denmark
PL	Warsaw University of Technology
SI	University of Maribor
CZ	Czech Technical University in Prague
UK	City University London

Question "***What is the duration, in years, adopted for the first cycle?***"

3 years: **17 answers**

SI	University of Ljubljana
DE	Technical University München

SI	University of Maribor
FR	University of Nantes
PT	Instituto Superior Técnico Lisbon
SE	Chalmers University of Technology
FR	Université Claude Bernard Lyon 1
NL	Delft University of Technology
BE	Katholieke Universiteit Leuven
BE	Université Catholique de Louvain
FI	Helsinki University of Technology
PT	University of Beira Interior Covilha
IT	Politecnico di Milano
PT	Universidade do Porto
IT	University of Pisa
UK	Cardiff University
UK	Loughborough University

3,5 years: **2 answers**

DE	Fachhochschule Oldenburg
PL	Rzeszow University of Technology

4 years: **14 answers**

UK	Heriot Watt University
HU	Budapest University of Technology and Economics
RO	Technical University Cluj-Napoca
RO	Technical University of Civil Engineering Bucharest
PL	Warsaw University of Technology
CZ	Czech Technical University in Prague
UK	City University London
ES	Universidade da Coruña
ES	Universidad Politecnica de Madrid
RO	Technical University “Gh. Asachi” Iasi
TR	Istanbul University
UK	Imperial College London
TR	Middle East Technical University, Ankara
GR	Technological Education Institute of Serres

Question "***What is the duration, in years, adopted for the second cycle?***"

38 answers received

1 year: 3 answers

UK	Cardiff University
UK	Heriot Watt University
UK	City University London

1,5 years: 4 answers

HU	Budapest University of Technology and Economics
CZ	Czech Technical University in Prague
RO	Technical University "Gh. Asachi" Iasi
RO	Technical University of Civil Engineering Bucharest

1,5 – 2 years: 3 answers

RO	Technical University Cluj-Napoca
DE	Fachhochschule Oldenburg
LT	Vilnius Gediminas Technical University

2 years: 24 answers

SI	University of Ljubljana
DE	Technical University München
SI	University of Maribor
FR	University of Nantes
PT	Instituto Superior Técnico Lisbon
SE	Chalmers University of Technology
FR	Université Claude Bernard Lyon 1
NL	Delft University of Technology
BE	Katholieke Universiteit Leuven
BE	Université Catholique de Louvain
FI	Helsinki University of Technology
PT	University of Beira Interior Covilha
IT	Politecnico di Milano
PT	Universidade do Porto
IT	University of Pisa
PL	Rzeszow University of Technology

PL Warsaw University of Technology
ES Universidade da Coruña
ES Universidad Politecnica de Madrid
TR Istanbul University
TR Middle East Technical University, Ankara
SK Slovak University of Technology in Bratislava
SK University of Zilina
DK Technical University of Denmark

Question **"*How is regarded in your university the first cycle degree in civil engineering?*"**

- **being in itself relevant to the European labour market, conferring employability: 12 answers**

FR University of Nantes
UK City University London
RO Technical University Cluj-Napoca
RO Technical University of Civil Engineering Bucharest
HU Budapest University of Technology and Economics
EE Tallinn University of Technology
DE Fachhochschule Oldenburg
LT Riga Technical university
UK Loughborough University
IT Politecnico di Milano
ES Universidad Politecnica de Madrid
DK Technical University of Denmark

- **as a break or pivot point suitable for mobility: 10 answers**

FR University of Nantes
DE Fachhochschule Oldenburg
DK Technical University of Denmark, Lingby
BE Katholieke Universiteit Leuven
PT University of Beira Interior Covilha
SI University of Maribor
BE Université Catholique de Louvain
FI Helsinki University of Technology
IT University of Pisa
NL Delft University of Technology

➢ **both: 20 answers**

DE	Fachhochschule Oldenburg
DK	Technical University of Denmark
RO	Technical University "Gh. Asachi" Iasi
PL	Warsaw University of Technology
CZ	Czech Technical University in Prague
PT	Instituto Superior Técnico Lisbon
PT	Universidade do Porto
SK	Slovak University of Technology in Bratislava
ES	Universidade da Coruña
TR	Istanbul University
UK	Cardiff University
UK	Heriot Watt University
SI	University of Ljubljana
DE	Technical University München
SE	Chalmers University of Technology
FR	Université Claude Bernard Lyon 1
PL	Rzeszow University of Technology
TR	Middle East Technical University, Ankara
LT	Vilnius Gediminas Technical University
FR	Institut Supérieur Du Bâtiment Et Des Travaux Publics Marseille

➢ **other (please specify): 3 answers**

FR	University of Nantes	For the first cycle: (i) In the Faculty of Sciences, the first cycle does not lead to employability. It is a necessary degree to access the Master degree. However, in the IUT (Technological University Institute), the transition from Bac+2 to Bac+3 (i.e. Professional Licence) is certainly interesting for employability in Europe.
DK	Technical University of Denmark	The student chooses at entry to follow a 3½ year professional program leading directly to the labour market or a 3 year academic program leading to the second cycle.
SK	University of Zilina	preparation for the second cycle of study

4. THE NEW FIRST CYCLE DEGREE PROGRAMMES IN CIVIL ENGINEERING IN EUROPE

By the time of the Bologna Declaration, June 20, 1999, the picture offered by the civil engineering education in Europe was rather simple. [1] Two basic systems were present:

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

In the years to follow, the picture gradually changed. The most significant was the transformation of some long duration programmes, named also "integrated programmes", which were split in two-cycle or two-tier programmes. A whole new breed of first cycle degree programmes were thus formed. [2]

A consultation undertaken prior to the General Assembly in Santander by the author, as responsible for the Theme A of the EUCEET III Project, revealed the interest of a large number of partners in better learning on the ways in which these programmes were built and implemented. It was thus taken the decision to combine the foundation of the Working Group for the Theme A during the General Assembly in Santander with the organization of a Workshop.

The first Workshop under the Theme A took place in Santander on 16th March 2007 with the title: "*The new first cycle degree programmes in civil engineering in Europe – problems and solutions*".

The papers presented at the Workshop in Santander are given in the Annex I of this report.

5. CIVIL ENGINEERING MASTER PROGRAMMES IN EUROPE – FINDINGS OF A EUCEET III SURVEY

A survey on Master programmes was undertaken by the Working Group for the Theme A, whose findings, presented at the 2nd EUCEET III General Assembly, will be presented in what follows.

Three types of Master programmes were considered in the survey:

- **Consecutive Master programmes**, requiring between 60 and 120 ECTS and built on a Bachelor programme.

- **Integrated Master programmes**, leading straight after 4 years of study to a degree named Master of Engineering (MEng), in England and Wales, and after 5 years to a degree equivalent to Master
- **Master plus programmes**, following an integrated programme, requiring between 60 and 120 ECTS

Consecutive Master programmes

In the Glossary which was added to the questionnaire, the following definition was given for consecutive Master programmes: *Master programmes leading to a Second Cycle Degree*, *for which the access requires successful completion of First Cycle Degree studies, lasting a minimum of three years*.

22 answers were received from:

AT	Katholieke Universiteit Leuven
CZ	Technical University of Ostrava
CZ	Czech Technical University Prague
DE	University of Applied Sciences Oldenburg
DE	Technical University Darmstadt
DK	Technical University of Denmark, Lyngby
HU	Budapest University of Technology and Economics
IE	Trinity College Dublin
IE	University College Dublin
IT	University of Pisa
IT	Politecnico di Milano
LT	Vilnius Gediminas Technical University
LV	Riga Technical University
NL	Delft University of Technology
PL	Rzeszow University of Technology
PL	Bialystok Technical University
PT	University of Beira Interior, Covilha
RO	Technical University of Civil Engineering Bucharest
SE	Chalmers University of Technology/
SK	Slovak University of Technology in Bratislava
SK	University of Žilina
UK	Cardiff University
UK	Imperial College London

Additional data were found on the website of other EUCEET III partners.

AT	Graz University of Technology
BE	University of Liege
DK	Aalborg University

IS	University of Iceland
NO	Norwegian University of Science and Technology, Trondheim
UK	Loughborough University
UK	City University London

As for the **name of qualification awarded**, various answers are summarized in the following table:

BE	Master in engineering science
CZ	Civil Enginer
DE	Master of …
DK	MSc in Civil Engineering
HU	MSc
IE	MSc
IT	Master of Science in Civil Engineering/Master degree or second cycle degree
LT	Master in Civil Engineering
LV	Master of Engineering
NL	MSc in Civil Engineering
PL	Master of Science in Civil Engineering/ Master of Science - Engineer
PT	Master of Science in Civil Engineering
RO	MSc in Civil Engineering
SE	Master of Science
SK	Engineer
UK	MSc in … /MEng in ...

Duration of consecutive Master programmes.

- 1 year (60 ECTS) – 5 answers + 1 website data:

IE	Trinity College Dublin
LV	Riga Technical University
UK	Cardiff University
UK	Loughborough University
UK	Imperial College London
UK	City University, London

A peculiarity presents Trinity College Dublin, where 90 ECTS are required for one year.

In the case of part time studies, the duration extends to 2 years (Trinity College Dublin, Loughborough University).

- 1.5 years (usually 90 ECTS) – 6 answers:

CZ	Technical University of Ostrava
CZ	Czech Technical University Prague
HU	Budapest University of Technology and Economics
PL	Rzeszow University of Technology
PL	Bialystok Technical University
RO	Technical University of Civil Engineering Bucharest
RO	Technical University of "Gh. Asachi" Iasi

Some peculiarities:
- for Technical University of Ostrava and Czech Technical University Prague, the Consecutive Master programmes in Architectural Engineering is a 2 years programme, with 120 ECTS;
- for Rzeszow University of Technology, same duration but 100 ECTS
- for Bialystok Technical University, same duration but 120 ECTS

- 2 years (120 ECTS) 11 answers + 9 website

AT	Graz University of Technology
BE	Katholieke Universiteit Leuven
BE	University of Liege
DE	Technical University Darmstadt
DK	Technical University of Denmark, Lyngby
DK	Aalborg University
IS	University of Iceland
IE	University College Dublin
IT	University of Pisa
IT	Politecnico di Milano
LT	Vilnius Gediminas Technical University
NL	Delft University of Technology
NO	Norwegian University of Science and Technology
PT	University of Beira Interior, Covilha
SE	Chalmers University of Technology
SK	Slovak University of Technology in Bratislava
SK	University of Žilina
RO	University PolitehnicaTimisoara

Concerning the **number of Consecutive Master Programmes offered**, this varies between 1 (University College Dublin) and 18 (Czech Technical University Prague).

The **names of the degree courses (specializations)** show a wide variety, as one can realize from the following table 1:

Table 1

1. Applied Earth Sciences	NL
2. Offshore Engineering	NL
3. Geomatics	NL
4. Civil engineering	BE
5. Geotechnical and Mining engineering	BE
6. Professional Master in Civil Engineering	LV
7. Geodesy and Cartography	CZ
8. Surveying and Cartography	SK
9. Geodesy and Geoinformation	DE
10. Surveying and Geoinformatical Engineering	HU
11. Geo and Water Engineering	SE
12. Environmental Water Engineering	UK
13. Geotechnics and Environment	PT
14. Geoenvironmental Engineering	UK
15. Geotechnics	CZ, IT, RO
16. Infrastructural Engineering	HU
17. Building Environment	CZ, SK
18. Environmental Engineering	CZ
19. Landscape engineering	SK
20. Buildings environment equipment	SK
21. Structures and design in architecture	SK
22. Buildings and architecture	SK
23. Architecture and Building Engineering	DK
24. Architectural Engineering	CZ
25. Civil Engineering	DK, LT, UK
26. Civil Constructions	IT
27. Construction Engineering	LT
28. Civil engineering structures	SK
29. Engineering of Structural Works	PL
30. Structural Engineering Program	HU, IT, UK
31. Structural Engineering Building Performance Design	SE
32. Structures and Construction	PT
33. Building Structures	CZ, LT, PL, SK
34. Building Constructions	CZ
35. Construction materials and products	LT
36. Building Materials and Diagnostics of Structures	CZ
37. Building construction preparation, realization and operation	CZ
38. Building technology	SK
39. Urban building engineering	PL
40. Municipal Engineering and Town Planning	CZ
41. Sustainable buildings	PL
42. Bridge building and maintenance	PL
43. Road Engineering	PL
44. Road building and maintenance	PL
45. Transport, Infrastructure, Logistics	NL
46. Professional Master in Transportation Engineering	LV
47. Transportation Infrastructures Program	IT
48. Transport Constructions	CZ

49. Structural and Transportation Engineering	CZ
50. Transportation engineering	SK
51. Hydraulics, Transportations and Territory Engineering	IT
52. Hydraulic Engineering Program	IT
53. Water Management and Water Structures	CZ
54. Water engineering and management	SK
55. Construction Management and Engineering	NL
56. Management and Economics in the Building Industry	CZ
57. Management and Engineering in Civil Engineering	DE
58. Design and Construction Project Management	SE
59. Construction management	LT
60. International Project Management	SE
61. Facility Management and Real Estate Management	DE, LT
62. Project Management and Engineering	CZ
63. Information Systems in the Building Industry	CZ
64. Materials Engineering	CZ
65. Building Industry Management	CZ
66. Computational Engineering in Advance Design	CZ
67. Computer Aided Analysis of Structures	PL
68. Mathematic – computational Modeling	SK
69. Advance Master's in Structural Analysis of Monuments and Historical Constructions	CZ
70. Ergonomics in production	LT
71. Survey and Control Program	IT
72. Civil Protection Program	IT
73. Sound and Vibration	SE
74. Technical equipment of buildings	SK

As for the type of Consecutive Master Programmes, out of the 23 received answers:

- **11** have mentioned a **taught** Consecutive Master Programmes (BE, CZ, DK, HU, IT, PL, RO, SK);
- **12** have mentioned a **taught & research** Consecutive Master Programmes (DE, IE, LT, LV, NL, PT, SE, UK).

Concerning the **taught & research**, the total work load dedicated to research was evaluated up to

- **30% in 5 answers;**
- **between 30% and 50% in other 7 answers.**

The theme of the research work is normally assigned at the beginning of the programme in 3 answers (Vilnius Gediminas Technical University, Riga Technical University, and University of Beira Interior, Covilha).

The assignment of a research theme after a specified period of course work is mentioned in 5 answers, only one corresponding to previously declared

taught & research Consecutive Master Programmes (Chalmers University of Technology), while the others correspond to taught Consecutive Master Programmes, probably referring to the final thesis work (Katholieke Universiteit Leuven, University of Applied Sciences Oldenburg, Rzeszow University of Technology, Budapest University of Technology and Economics).

Admission criteria to the second cycle

Most respondents (16) ticked the first option: "directly after the first degree".

An explicit "admission examination criterion" was mentioned in 8 answers (Czech Technical University Prague, University of Applied Sciences Oldenburg, University of Pisa, Politecnico di Milano, Slovak University of Technology in Bratislava, Delft University of Technology, Budapest University of Technology and Economics, Technical University of Civil Engineering Bucharest, University of Žilina).

The option "after the completion of an intermediate degree" was chosen by 3 respondents (University of Leuven - only if the candidate has no BCs degree in Civil or Geotechnical Engineering, Czech Technical University Prague, Cardiff University) and also in case foreign candidates for a few more (University of Applied Sciences Oldenburg, University of Beira Interior, etc). The latest probably refer to a home language certificate or course.

As "other" option (criterion), the relevance of the institution that delivered the candidate's BSc degree was mentioned. However, most web-sites of institutions delivering a Consecutive Master Programme, suggest as admission criterion information appended to the candidate's application regarding his previous results during and at the end of the first cycle.

The number of places dedicated to Consecutive Master Programmes

Very diverse throughout the surveys answers, because of the different size of the institutions and various levels the respondent refers to.

The average number of master students graduating per year is between 15 (University of Applied Sciences Oldenburg, University of Pisa) and 650 (CTU in Prague).

The number of places is limited by national regulations in 6 countries (CZ - Czech Technical University Prague, Technical University of Ostrava, DE - University of Applied Sciences Oldenburg, HU - Budapest University of Technology and Economics, LT - Vilnius Gediminas Technical University, LV - Riga Technical University, PT - University of Beira Interior).

The number of places limited by university/faculty/department regulations are common for 10 institutions (Czech Technical University Prague, Technical University of Denmark, University of Applied Sciences Oldenburg, University College Dublin, Politecnico di Milano, Riga Technical University, Rzeszow University of Technology, Bialystok Technical University, University of Beira

Interior, and Slovak University of Technology in Bratislava, University of Žilina). Sometimes, the respondent's options are in this case overlapped.

The number of places is limited due to financial and other resources in case of 8 answers (Technical University of Ostrava, University of Applied Sciences Oldenburg, Riga Technical University, Rzeszow University of Technology, Bialystok Technical University, Chalmers University of Technology and Slovak University of Technology in Bratislava).

Students with a foreign qualification need a recognition procedure before being admitted in almost all answers (16), except University of Pisa and Cardiff University which didn't mention and the Technical University of Ostrava where such a procedure is not necessary.

For a home student, a satisfactory performance in a competitive examination is needed according to 6 answers (Czech Technical University Prague, University of Applied Sciences Oldenburg, Vilnius Gediminas Technical University, Riga Technical University, Budapest University of Technology and Economics, Technical University of Civil Engineering Bucharest).

The average ratio between the number of master students graduating per year and the number of first cycle degree students graduating per year varies between 0.15 and 1.0 (15% and 100%) as results from the following table:

BE	University of Leuven	0.5
CZ	Technical University of Ostrava	0.8
CZ	Czech Technical University Prague	0.8
DE	University of Applied Sciences Oldenburg	0.15
DK	Technical University of Denmark, Lyngby	0.5
HU	Budapest University of Technology and Economics	0.3
IE	Trinity College-Dublin	0.22
IT	University of Pisa	0.3
IT	Politecnico di Milano	0.5
LT	Vilnius Gediminas Technical University	0.47
LV	Riga Technical University	0.68
NL	Delft University of Technology	1
PL	Rzeszow University of Technology	0.25
PL	Bialystok Technical University	0.9
PT	University of Beira Interior, Covilha	0.8
SE	Chalmers University of Technology Göteborg	0.75
SK	Slovak University of Technology in Bratislava	0.9
SK	University of Žilina	0.4
UK	Cardiff University	0.5

The typical age of students obtaining master degree is between 22 years (Cardiff University) and 27 years (University of Pisa).

The **percentage of female master graduates** is between 15% (Katholieke Universiteit Leuven) and 50% (University College Dublin).

The percentage of the **master graduates from the home country** ranges for most answers between 85% in Delft University of Technology to 100% (University of Leuven, University of Pisa, Riga Technical University, Bialystok Technical University). Lower percentages are typical for Chalmers University of Technology Göteborg (70%) and Cardiff University (20%).

Master Plus Programmes

In the Glossary, *Master Plus Programmes* were defined as *Master programmes following Integrated programmes or Consecutive Master programmes*. By the successful completion of Master plus programmes, a Degree or a Certificate can be awarded

The Master Plus Programmes are encountered normally in institutions where the two-tier education system was not implemented. In some countries this programme is temporarily maintained in parallel with the Consecutive Master Programmes, until the two-tier system will completely replace the previous integrated system. The Master Plus programmes is following an integrated education system, lasting usually 5 years, with a common amount of 300 ECTS.

Number of received answers: 8

Answers concerning this topic are covering 5 countries: DK, FR, GR, PL, RO.

DK	Technical University of Denmark, Lyngby
FR	Institute National of Applied Sciences, Lyon
FR	Higher Institute in Building and Infrastructures Design, Marseille
FR	Ecole Nationale des Ponts et Chaussées, Paris
GR	National Technical University of Athens
GR	University of Patras
PL	Warsaw University of Technology
RO	Technical University Gh. Asachi Iasi

It is significant to be mentioned that according to the answer sent by the Technical University of Denmark, both types of masters are awarded (also the Consecutive Master Programme).

The qualification names differ from one country to another and even for institutions belonging to the same country, as shown in table 2.

Table 2.

DK	Technical University of Denmark	Master
FR	Institute National of Applied Sciences Lyon	Master (research master)
FR	Higher Institute in Building and Infrastructures Design, Marseille	Specialization engineer diploma
FR	Ecole Nationale des Ponts et Chaussées, Paris	Post –Master Professional Certificate
GR	National Technical University of Athens	Postgraduate Specialization Diploma
GR	University of Patras	MSc in Civil Engineering
PL	Warsaw University of Technology	MSc Eng
RO	Technical University Gh. Asachi Iasi	Advanced Studies Certificate

Because the integrated system is considered as being equivalent to a Master degree, higher education institutions such as ENPC Paris are awarding the title of Master of Engineering or Master of Science degree (according to the partnership with other institutions), at the end of the 3 years of study (in total 5 years, considering also the 2 years of "classes préparatoires"). In this case, some specialization occurs during the last 3 or 4 semesters of the 3 years programme. Hence, the Post-Master certificate is actually a Master plus programme.

In the Annex II of this report is given the questionnaire for the EUCEET Survey on Master Programmes. Sample curricula of Consecutive Master programmes and of Master Plus programmes are also given.

6. A CASE STUDY: GEO-ENGINEERING SCIENCES IN CIVIL ENGINEERING DEGREE PROGRAMMES

A Workshop on the Bologna process and its impact on the education in geo-engineering sciences in Europe took place in Constantza, on 2 – 3 June 2008. The Workshop was included in the programme of the "*First International Conference on Education and Training in Geo-engineering Sciences: Soil Mechanics and Geotechnical Engineering, Engineering Geology, Rock Mechanics*".

35 people attended the Workshop, representing the following EUCEET III partners:

CZ Czech Technical University Prague
DE Technical University Dresden
FR Ecole Speciale des Travaux Public Paris
FR Institute National of Applied Sciences, Lyon
GR National Technical University of Athens
GR Technological Education Institution of Serres

HU	University of Pecs
IE	Trinity College Dublin
IT	University of Pisa
LT	Vilnius Gediminas Technical University
NL	Delft University of Technology
PT	Instituto Superior Tecnico, Lisbon
PT	Laboratorio Nacional de Engenharia Civil Lisbon
RO	Technical University "Gh. Asachi" Iasi
RO	University "Ovidius" Constantza
RO	Technical University of Civil Engineering Bucharest
SK	University of Žilina
TR	Istanbul University
TR	Middle East Technical University, Ankara
UK	City University London
UK	Imperial College London
UK	Heriot Watt University

In the 1st part of the Workshop, on 2nd June 2008, chaired by Prof. Iacint Manoliu (Romania), were presented the following papers:

1. Prof. Nicoleta Radulescu (Romania): *Short presentation of the Thematic Network Project EUCEET (European Civil Engineering Education and Training)*
2. Prof. Iacint Manoliu (Romania): *The Bologna process and its impact on the education in geo-engineering sciences in Europe as revealed by a survey undertaken by the EUCEET III Working Group A*
3. Dr. Dominique J.M Ngan-Tillard, Ir. J.P. Oostveen, Dr. C.M.J.van Kuijen (Netherlands): *Geo-engineering, a co-production of applied earth sciences and civil eng.*
4. Ing. Chamra Svatoslav, Dr. Jan Pruška, Ing. Radek Vašiček (Czech Republic): *Complex Education in Underground Structures at CTU in Prague*
5. Prof. Vlasta Szavits-Nossan (Croatia): *Education and training in geo-engineering sciences in Croatia*

In the 2nd part of the Workshop, on 3rd June 2008, chaired by Prof. Jozsef Mecsi (Hungary), were presented the following papers:

1. Prof. Marina Pantazidou, Assoc.Prof. George Tsiambaos, Prof. Dimitrios K. Atmatzidis (Greece): *Geotechnical engineering education and training in Greece and links with the geo-engineering sciences*
2. Prof. Diego Lo Presti, F. Silvestri (Italy): *Report on the education and training in geo-engineering sciences in Italy*

3. Dr. Bryan McCabe, Dr. Declan Phillips, Prof. Trevor Orr, S.P. Murray (Ireland): *Geotechnical Education in Ireland - 2008 National Report*
4. Prof. Kastytis Dundulis, Prof. Vincentas. Stragys (Lithuania): *Geo-engineering education in Lithuania*
5. Prof. Iacint Manoliu, Prof. Cristian Mărunteanu, Prof. Dan Stematiu (Romania): *Education and training in geo-engineering sciences in Romania*

A survey undertaken by the Working Group A of EUCEET III was aimed at defining the place of geo-engineering sciences in the curricula of various degree programmes. The answers received were grouped according to the following types of programmes:

- First cycle degree programmes of 3-year duration
- First cycle degree programmes of 4-year duration
- Second cycle degree programmes (consecutive master) of 1 – 2 year duration
- Integrated programmes of 4-year duration
- Integrated programmes of 5-year duration
- Master plus programmes

Data obtained from the survey for the 5 categories of programmes are given in the Annex III of the report.

7. CIVIL ENGINEERING EDUCATION IN EUROPE – 2009, 10 YEARS AFTER THE BOLOGNA DECLARATION

7.1 Brief overview of the Bologna Process

In fact, one can better say "*11 years after the Bologna Process was triggered*". Indeed, the basic precepts of the Bologna Process are found in the Sorbonne Joint Declaration on Harmonization of the Architecture of the European Higher Education System, signed in May 25, 1998 by the education ministers of France, Germany, Italy and United Kingdom.

The Sorbonne Declaration called for a gradual convergence towards a common framework of qualifications and cycles of study and for the design of a common degree level system for undergraduate (bachelor's degree) and graduates (master's and doctoral degrees).

The "*Bologna Declaration on the European Higher Education*" was signed on June 19, 1999 by ministers responsible for higher education in 29 European countries, which were then 15 EU Member States, three EFTA countries and 11 EU candidate countries. Six action lines were defined:

- Adoption of a system of easily readable and comparable degrees;
- Implementation of a system essentially based on two main cycles, undergraduate and graduate. Access to the second cycle shall require

successful completion of the first cycle studies, lasting a minimum of three years. The degree awarded after the fist cycle shall also be relevant to the European labour market.
- Establishment of systems of credits such as ECTS;
- Supporting the mobility of students, teachers and researchers;
- Promotion of European cooperation in quality assurance;
- Promotion of the necessary European dimension in higher education particularly with regards to curricular development, inter-institutional cooperation, mobility schemes and integrated programme of study and research.

The Communiqué of the Conference of Ministers of Higher Education in Prague "*Towards the European Higher Education Area*" had 33 signatory countries (29 Bologna signatory countries, plus Cyprus, Turkey, Liechtenstein, Croatia).

Three new action lines were added to the ones defined in Bologna:
- Promotion of lifelong learning;
- Involvement of higher education institutions and students;
- Enhancement of the attractiveness of the European Higher Education Area.

With the Berlin Communiqué of September 19, 2003, "*Realising the European Higher Education Area*", the number of signatory countries reached 40: 33 Prague signatory countries plus Albania, Andorra, Bosnia and Herzegovina, FYR Macedonia, Holly See, Russia, Serbia and Montenegro.

A 10th action line was added: Inclusion of the doctoral level as the third cycle in the Bologna Process.

A number of priorities were established for the next two years, such as:
- Starting the implementation of the two-cycle system;
- Recognition of degrees and periods of studies, including the prevision of the Diploma supplement automatically and free of charge for all graduates as of 2005;
- Elaborating of an overarching framework of qualifications for the European Higher Education Area.

The following Conferences of the Ministers responsible for higher education did not add new action lines but marked achievements of the Bologna Process and established priorities for the next two years.

With the Communiqué in Bergen (2005) "*The European Higher Education Area – Achieving the Goals*" the number of signatory countries reached 45, with the inclusion of Armenia, Azerbaijan, Georgia, Moldova and Ukraine. The Conference marked the adoption of the "*Standards and Guidelines for Quality*

Assurance in the European Higher Education Area" and the "*Framework of Qualifications for the European Higher Education Area*".

In the priorities for 2007 were included:

- developing national frameworks of qualifications in compatibility with the adopted Framework of Qualifications for the European Higher Education Area;
- implementing of the standards and guidelines for quality assurance;
- awarding and recognizing joint degrees.

At the London meeting of Ministers (17 – 18 May 2007), was established the first legal body to be created through the Bologna Process, namely the European Quality Assurance Register (EQAR).

In London, also, Ministers decided to develop national action plans with effective monitoring of the social dimension and to adopt a strategy to improve the global dimension of the Bologna process.

The number of signatory countries reached 46, with the inclusion of the Republic of Montenegro as an independent state.

The Ministers responsible for higher education in the 46 countries of the Bologna Process convened in Leuven/ Louvain-la-Neuve on April 28 and 29, 2009, took stock of the achievements of the Bologna Process and established the priorities for the European Higher Education Area (EHEA) for the next decade. The Communiqué of the Leuven/ Louvain-la-Neuve Conference was, accordingly, entitled "The Bologna Process 2020 – The European Higher Education Area in the new decade"

Higher education priorities for the decade to come in which must be found the higher education priorities are examined in the Communiqué in the context of a number of relevant items, such as:

- Social dimension: equitable access and completion
- Lifelong learning
- Employ ability
- Student – centred learning
- Education, research and innovation
- International openness
- Mobility
- Multidimensional transparency tools
- Funding

It was decided to have the next regular ministerial Conference in Bucharest, on 27 – 28 April 2012, after which the conferences will be held in 2015, 2018 and 2020.

7.2 Action line 2: implementation of a system essentially based on two main cycles

The two-tier system is practically generalized in engineering education

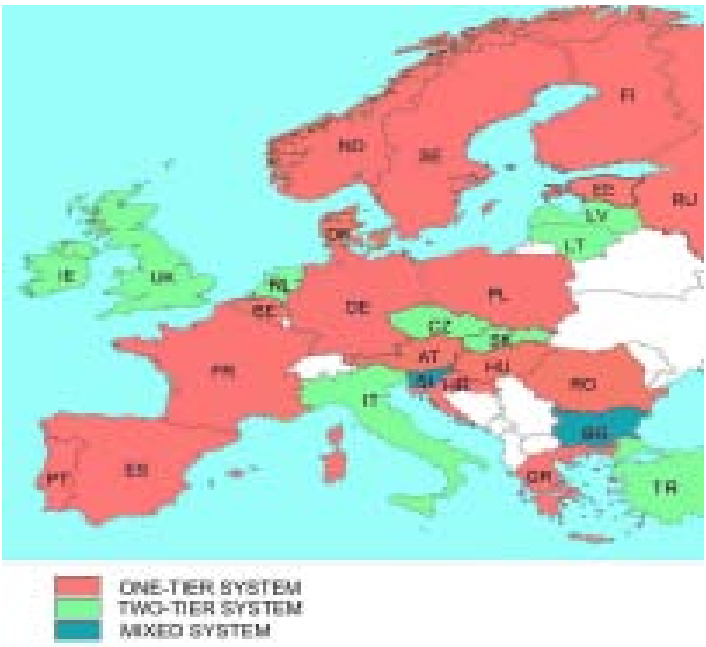
Action line 2 was, without any doubt, the most challenging, but also most controversial, requirement of the Bologna Declaration, as far as the engineering education in Europe is concerned.

Let's consider the evolution of degree structures at higher education institutions belonging to the university sector and offering engineering programmes.

In the academic year 1999-2000, taken as a starting point, the integrated, one-tier programmes, leading straight to a degree equivalent to a Master degree, were present in all countries, except U.K., Ireland, Baltic countries and Turkey, where two-tier programmes were in operation (fig.1).

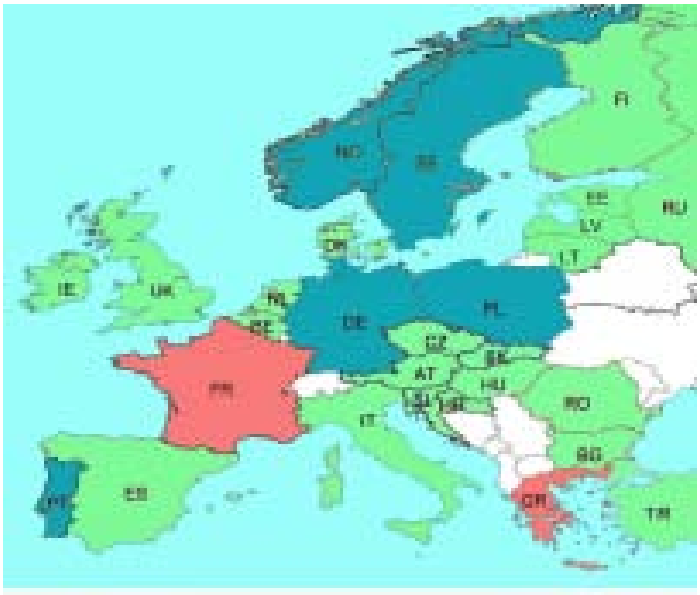
Figure 1

Four years later, in 2003-2004, the two-tier system was already introduced in Italy, Netherlands, Czech Republic and Slovakia (fig.2). The academic year 2005-2006 marked a further extension of the two-tier system in Romania, Belgium, Austria, Croatia, Hungary, Denmark, while in Portugal, Germany, Poland, Norway, Sweden, a "mixed systems" characterized by the coexistence of integrated programmes and two-tier programmes was present (fig.3).



ONE-TIER SYSTEM
TWO-TIER SYSTEM
MIXED SYSTEM

Figure 2



ONE-TIER SYSTEM
TWO-TIER SYSTEM
MIXED SYSTEM

Figure 3

In 2009-2010 the transition from integrated programmes to two-tier programmes can be considered completed (fig.4), with tow notable exceptions: France and Greece.

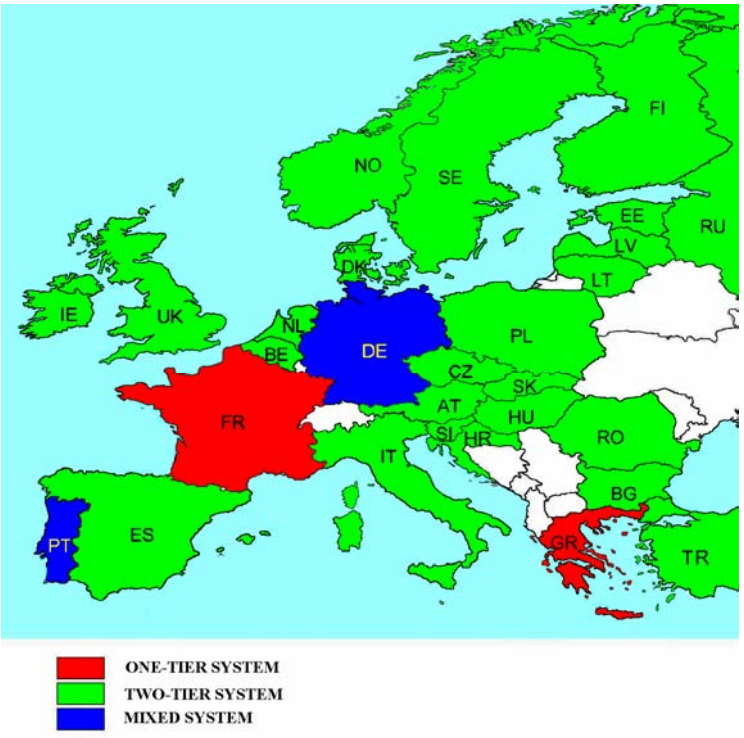


Figure 4

In France as it is known, most engineers are graduates of the "Grandes Ecoles", institutions which recruit their students at the BAC+2 level, i.e. after they spend two years ("classes préparatories") in selected high-school (lycées) or in some universities. The studies in the "Grandes Ecoles" last 3 years which, added to the 2 preparatory years, lead in fact to a 5-year integrated programme. For the "Grandes Ecoles", adoption of a two-tier system is, practically, impossible.

As for Greece, participants at the first EUCEET II General Assembly held in Athens, remember the lecture given by the then Rector of the National Technical University of Athens, Prof. Temistocles Xanthopoulos [3], in which was stated: "*We reject explicitly the main objective of the Bologna Declaration, namely the compulsory and universal division of all University courses into two cycles*". Seven years later, on 13th February 2010, at the CLAIU-EU Conference "Engineering Master Degrees in Europe" hosted by the Royal Military Academy, Brussels, the new Rector of the university, Prof. Konstantinos Moutzuris, reiterated the same position.

One has to mention, however, than even in the countries considered as belonging to the two-tier system, there are some exceptions. Thus, in Germany, Technical University Dresden did not introduce so far the Bachelor-Master programme, continuing to offer the 5-year integrated programmes. In Portugal, where the two-tier system was implemented, the Ministers of Education allowed leading universities in the field of engineering: Instituto Superior Tecnico Lisbon, University of Porto and Coimbra University to continue to run 5-year integrated programmes, in parallel with the 3+2 programmes. A similar solution is applied at the Norwegian University of Science and Technology Trondheim.

The 3 + 2 formula and some problems raised by its adoption

As for the transition from the integrated 5-year system to the two-tier system, the EUCEET III survey revealed that in most countries the 3+2 formula was adopted. The Bachelor degree introduced by this formula is seen primarily as a **break** or **pivot point** suitable for mobility and to less extent for employability. An implicit assumption seems to prevail, namely that if not all but a vast majority of students are going to continue studies at the same university until the 3+2 programmes is completed.

Two lectures presented at the CLAIU-EU Conference in mentioned before gave some insights into the problems faced in two countries in which the 3+2 system was adopted [4], [5].

Speaking about "*Development of the Bologna Degrees in Germany*", Prof. Jörg Steinbach, Vice-President of TU Berlin, pointed out reasons which made students to go on strike in 2009.

- workload too high (time of lectures vs. length of term; too many examinations per term)
- curricula too structured (not enough degrees of freedom for self selected modules; too stringent succession of modules)
- no guarantee to become enrolled in a master programme
- almost no job market for bachelors.

Some students asked for the adoption of a 6-year education system: 4+2, meaning in fact the extension of the bachelor programme which, in their opinion, is too compressed and, in addition, not well accepted by the labour market. Speaking about possibilities of a reform in Germany, Prof. Jörg Steinbach invoked a so-called "*Spanish model*" in which, some institutions seem to offer to the student, after he/she completes the first 3 years of study two options: either to continue for a 4^{th} year which will lead them to completion of a Bachelor programme giving access to the job market or to continue directly with 2 more years of a research oriented curriculum, getting the integrated master degree.

Prof. Alfredo Squarzoni from University of Genova, showed that implementation of a "**reform of the reform**" is under way in Italy, which was

the first country to make in 2001-2002 the shift from the integrated programme to two-tier programme, as a result of a decree issued in November 1999, just a few months after the Bologna Conference. At that moment, a binary system was in operation with two programmes in parallel (5-year programmes leading to "**Laurea**" degree and 3-year programmes leading to "**Diploma**" degree). The decree replaced the binary system with a two-tier system of 3+2 type, with "**Laurea**" in the first cycle and "**Laurea Specialistica**" in the second cycle. The decree asked for the first cycle programmes to supply students with adequate mastering of general scientific methods and contents and specific professional skills. As a consequence, the resulting first cycle programmes were more "practice-oriented" than "theory-oriented", resembling very much with the old Diploma programmes. "*The implementation of the Bologna process*, showed Prof. Squarzoni, *has resulted in a generalized decrease in the educational level of second cycle graduates with respect to the graduates of the old five-year Laurea. In this context, it must not be a surprise if last year the National Council of Engineers, which represents all the Engineers Associations (Ordini) established on a provincial basis, acquired a whole page of one of the most Italian newspaper to publicly ask the Minister for University to re-introduce the "old" five-year Laurea*".

The basis of the "**reform of the reform**" was put by the decree 270/2004, but its implementation became operative only with the academic year 2008-2009 and is expected to be completed by the academic year 2010-2011 at latest. According to the reform, the obligation to guarantee the acquisition of specific professional skills in first cycle programmes is abolished, opening the way for a revision of the curricula leading to a strengthening of the basic disciplines. A clear distinction is made between curricula oriented to the prosecution of studies in **Laurea Magistrale** (the new name of Laurea Specialistica) programmes, i.e. curricula which have the aim to supply student with adequate mastering of scientific methods and contents only, and curricula which intend to prepare students for the job market, i.e. oriented to the acquisition of specific professional competences also.

The 4+… formula and the relevance of the first cycle degree for the labour market

There are a number of countries in which the shift from the integrated 5-year programmes to two-tier study programme was made by introducing a 4-year first cycle programme followed by 1.5 or 2 years second cycle programme. It is worth to remind that this solution was in line with the following position statement adopted in Paris on 16th February 2004 by the EUCEET Management Committee on the implementation of the Bologna Declaration in civil engineering education: "*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."

The EUCEET III survey showed that all universities which introduced a 4-year first cycle degree consider this degree as being in itself relevant to the European labour market and conferring employability, as required by the Bologna Declaration. Study programmes of 4-year duration for the first cycle are offered, as a result of the Bologna process, by universities from Czech Republic, Hungary, Poland, Romania, Spain. Before Bologna process, such programmes were offered in U.K., Turkey, Latvia and Lithuania.

As shown before, the "continental system" was characterized by the presence of two types of programmes in parallel:

- long duration programmes (5 years, exceptionally 6 years)
- short duration programmes (3 – 3.5 – 4 years)

In what follows, two cases will be tackled, showing the impact of the Bologna process on the binary system.

In Romania, before the implementation starting with the academic year 2005-2006 of the new "*Law on the organization of university studies*", coexisted two types of undergraduate programmes:

- the long duration – 5 year programme – leading to a degree named in Romanian "*Inginer Diplomat*", an integrated programme considered to be equivalent to a M.Sc. degree in the two-tier system;
- the short duration – 3 year programme – leading to a degree named in Romanian "*Inginer Colegiu*" considered to be equivalent to a B.Sc. degree in the two-tier system.

9 universities offered long duration programmes and 6 university colleges offered short duration programmes. One has to mention that university colleges

were not autonomous institutions, but belonged to universities. Under conditions established by the Senate of each university, a graduate of the 3-year programme could continue his/her education to become "Inginer Diplomat". This implied at least the equivalent of one-year courses for a "bridge", after which admission was granted in the 4th year of study of the long programme.

According to the new Law, university studies in Romania are organized in three cycles:

- the first cycle with a duration of 3 – 4 years (180 – 240 ECTS Credits) is called "Licenta" (synonym with "Licence" in French). The Law stipulates that for engineering education the first cycle is of 4-year duration. The qualification level acquired by the graduates of the first cycle should be adequate for providing employability;
- the second cycle with a duration of 1 – 2 years (60 – 12- ECTS Credits) is called "Master". The cumulated duration of the cycle I (Licence) and of the cycle II (Master) should correspond to **at least** 300 ECTS or 5 years;
- the third cycle, doctoral studies, having normally a duration of 3 year for intra-mural studies.

The Law specified that the existing short duration 3-year programmes are going to be dismantled, unless they can be transformed in programmes corresponding to licence level. This option was not adopted for the engineering programmes. Hence, starting with the academic year 2005 – 2006, only one kind of first cycle programmes, of 4-year duration, were offered by universities having engineering programmes.

For building the curricula for the new 4-year programmes, two simple options were available: either to compress the curricula of the previously existing 5-year (integrated) programmes or to expand the curricula of the dismantled 3-year programmes. In fact, neither one of the two options was followed. The new curricula aimed to confer to the graduate not only the engineering degree of "**inginer licenţiat**" but also full employability, was devised with due concern for a solid foundation represented by the basic subjects and the subjects on general technical education (Mechanics, Statics, Strength of Materials, Soil Mechanics, Fluid Mechanics), to which almost 50% of the 240 ECTS credits were allocated. Credits received for specialization (buildings, hydraulic works, transportation works etc) represent for the first cycle degree about 25%, proving that the graduates are of "*generalist*" type. A detailed presentation of the new 4-year progamme adopted at the Technical University of Civil Engineering Bucharest can be found elsewhere in this volume [6].

The second cycle programme in Romania leading to the Master degree, is of 1.5 year duration at all Universities offering such programmes in civil engineering, except University "Politehnica" Timişoara where is of 2 years duration.

As one can realize, the Bologna process transformed in Romania the binary system in a pure two-tier system, as long as the short duration practice-oriented programmes simply disappeared.

The situation is totally different in Spain, as it will be shown in what it follows.

Before the implementation of the Bologna process, in Spain existed two programmes put in parallel and leading to two different professional degrees [7].

The short duration, 3-year programme, for the degree called "*Ingeniero Tecnico de Obras Publicas*" (ITOP), was offered by 12 institutions. The long duration programme, was of 5-year duration at the Universities from Santander, Valencia, Barcelona, Granada, Corűna, Ciudad Real and Burgos and of 6-year duration only at the Universidad Politecnica de Madrid. The long duration programme lead to the degree of "*Ingeniero de Caminos, Canales y Puertos*" (ICCP). Three universities (Barcelona, Santander and Valencia) offered both ITOP and ICCP programmes.

The reform in Spain was implemented through the Royal Decree 1393/ 2007, which was followed by two orders of the Ministry of Education and Science, pertaining to the regulated professions of **public works engineer**, linked to the bachelor's degree and of **civil engineer**, linked to the master's degree.

The formula adopted in Spain is 4+2. The Bachelor degree corresponds to ITOP, while the Master degree corresponds to ICCP. Therefore, the reform extended the ITOP programme from 3 to 4 years while the time needed to get in addition the ICCP degree reached 6 years, as previously was the case only in Madrid.

The order regulating the Bachelor degree, specifies one year (60 credits) for basic education, one year (60 credits) for general technical education, 48 credits for specialization and 12 credits for the final project. Thus, 180 ECTS are regulated out of a total of 240, i.e. 75%. There is a striking similarity with the structure of the 4-year programme for the first cycle degree adopted in Romania by TUCEB.

In conclusion, what can be called "*Spanish model*" means putting the two previously existing programmes in serie. This was possible because, as in Romania, the Law stipulates that the total (cumulated) length of the first and second degrees should include **at least** 300 ECTS, and not *maximum* 300 ECTS as happened in countries which adopted the 3 + 2 formula, such as Germany.

Spain is the last country to implement the Bologna process and, as far as civil engineering education and profession is concerned, the two-tier system adopted is interesting and original. Graduates of the first cycle (bachelor) programme can call themselves "*Ingeniero Tecnico de Obras Publicas – Public Works Technical Engineer*" and their employability is certain. With two additional years of study, at master level, they can acquire the higher

professional qualification of "*Ingeniero de Caminos, Canales y Puertos – Roads, Channel and Harbour Engineer*".

Short duration programmes offered by the non-university sector

It would be of interest to see what was the impact of the Bologna process on other short duration programmes in civil engineering across Europe.

In Germany, short duration programmes of 4 years were offered by more than 40 Fachhochschulen (Universities of Applied Sciences). Following a framework law issued in 1998, before the Bologna Declaration, both Universities and Universities of Applied Sciences were allowed to adopt the two-tier system (Bachelor – Master) with the condition that the cumulated duration of the two programmes does not exceed 5 years (300 ECTS). Quickly, Fachhochschulen took the opportunity and organized 3.5 years programmes for Bachelor degree and 1.5 year programmes for Master degree. The Bachelor degree offered by these Universities of Applied Science can be regarded as a "*professional bachelor*", since it is more practice oriented. It gives not only access to the 1.5 year Master programmes but also is very much sought by the job market, in other words it confers employability. This cannot be said about the "*academic bachelor*", theoretically oriented, offered by the universities (Technical Universities or Comprehensive Universities) which adopted the 3 + 2 system previously discussed. It is to add, also, that the graduates of the "*professional bachelor*" are not admitted, in normal circumstances, to the Master programmes delivered at universities.

In Denmark, "*professional bachelor*" of 3.5 years is offered both in the non-university sector (at Colleges of Engineering) and in the university sector, being accepted for professional recognition by IDA – the Society of Danish Engineers. But such recognition is not given to "*academic bachelor*" in the 3 + 2 programmes introduced by the universities as a result of the Bologna process.

Finland witnessed in recent years a process of merging of Polytechnics located in various parts of the country, to create thus strong Universities of Applied Sciences offering 4-year Bachelor programmes not only in Finnish but also in English, able to attract both local and foreign students

In Portugal, 3-year short duration programmes, leading to a "*Bacharelato*" degree were offered before Bologna process, by the Polytechnic Institutes, while universities offered 5-year integrated programmes. As Bologna process started to be implemented, a change similar to the one in Germany occurred. Polytechnic Institutes were authorized to offer the so-called *Licenciatura bi-etapica* degree, which is a two stage degree including the first 3-year programme (*Bacharelato*) followed by a 2-year programme, resulting altogether in a *Licenciatura* degree [8]. Universities adopted also the 3+2 system, with a first degree seen primarily as an entry point to the Master programme.

Proliferation of Master degrees in civil engineering programmes – a main outcome of the implementation of the Bologna Process

The reader is invited to regard again the fig. 1 showing the distribution in the academic year 1999 – 2000 of the civil engineering programmes across Europe. Master degrees were offered by universities from U.K., Ireland, Baltic countries and Turkey. In all other countries, where the so-called "*continental system*" prevailed, one-tier 5-year programmes, lead to engineering degrees considered to be equivalent to Master degrees but without being named as such. Let's regard also the fig. 3 in which the situation at the level of the academic year 2009 – 2010 is presented. As shown, with the exception of France and Greece, the two-tier programmes are present everywhere, leading thus to the creation of a very large number of consecutive Master degree programmes in both university and non-university sector.

From the point of view of contents and outcomes, the new masters can be identified as *academic masters*, which are university – based programmes and *professional masters*, awarded normally by non-university higher education institutions.

Another distinction can be made between "*vertical masters*" and "*transversal masters*".

A "*vertical master*" pertains to the same specialization as the one taken by the student in the first cycle studies. Thus, the master programme "*Hydraulic Engineering"* offered by the Faculty of Hydrotechnics of the Technical University of Civil Engineering Bucharest is a "*vertical master*", being addressed to the graduates of the first cycle programme of the specialization "*Hydraulic structures*" of the same faculty.

A "*transversal master*" pertains to a specialization different from the one taken by the student in the first cycle studies. In this category can be placed the master programme "*Geotechnical engineering*" offered by the same faculty of TUCEB but addressed to the graduates of the first cycle programmes offered not only by that faculty but also by other three faculties for the field of civil engineering of the University: Faculty of Civil, Industrial and Agricultural Buildings, Faculty of Railroads, Roads and Bridges and Faculty of Engineering in Foreign Languages. Neither one of the faculties of the university has a specialization in "*Geotechnical engineering*" at the level of the first cycle.

The example with "*Geotechnical engineering*" illustrates one clear positive outcome of the proliferation of master programmes in civil engineering education in Europe, the possibility of awarding degrees in new domains, responding to the needs of the labour market.

Examining the list given in the table with the names of degree courses, which is far from being exhaustive, one can recognize many programmes of "*transversal*" type.

An important outcome of the implementation of the Bologna Process in civil engineering education is the curricular reform needed to adopt programmes to

the new degree structures, regardless if this structure was of 3 + 2 type or of 4 + … type. In the annexes of this report can be found examples of curricula for master programmes resulting from this curricular reform.

The "*Master plus programmes*", offered in first place by institutions which kept the integrated 5-year programmes, and in few cases by those which adopted the two-tier system, are presently in a clear minority with respect to the *consecutive master programmes*. However, they play a role in the lifelong learning agenda of respective universities.

7.3 Other facets of the implementation of the Bologna Process in civil engineering education

Mobility of students

Supporting the mobility of students, teachers and researchers was one of the six action lines defined in the Bologna Declaration.

Let's consider the mobility of students. Although statistics are not available, one can state that the changes occurred in civil engineering programmes did not favour the mobility of students at first cycle level, due to the differences in duration and structure of the new programmes, some of them of 3-year, other with 4-year duration. As a result, study periods of one year became a rarity at the first cycle, unlike the situation some years ago when 5-year integrated programmes prevailed. As for the second cycle, which could be of 1.5 or 2 year duration, a study period of one semester seems to best suit the new programmes.

The language barrier is obstructing the developments of students' mobility. However, the situation can improve and trend of building master programmes in English will continue.

The "*case study*" to follow will illustrate other type of difficulties to be faced by the mobility of students.

A student at TUCEB just completed the 2nd year of the new 4-year first cycle degree programme. His marks are excellent, he is ranked 1st among the 138 students of his class. So are his English language abilities. No wonder, then, that he won without any problem the competition for a 10-month study period, at the level of the 3rd year of study, in a university from England under the Erasmus programme. After a careful examination of courses/ modules offer at the university where the Erasmus study programme was supposed to take place, the student proposes to his Dean a list of 9 courses which all had a correspondent in the curriculum of the 4-year programme he is enrolled and, at the same time, lead of a total of 60 ECTS as required for one-year of study. The proposal is accepted by the sending institution but rejected by the receiving institution. The reason? Four of the nine courses in the programmes were offered at MSc level. The author of this report considered this rejection, decided by the International office of the host institution, as merely a bureaucratic act with no academic justifications, for a number of reasons, such as:

- courses taken by our student in the first two years, among which a 2-semester course of *Mechanics*, a 2-semester course of *Strength of materials*, a 2-semester course of *Structural analysis*, an one-semester course of *Elements of elasticity and theory of plates* and an one-semester course of *Reinforced and prestressed concrete*, represented a solid background and clearly met the requirements for the four modules found in the MSc offer: *Stability of structures*, *Design of concrete structures*, *Dynamics of structures* and *Finite element method*
- the purpose of the Erasmus study programme abroad was to attend a number of courses best suited for full recognition to as part of the 240 ECTS required for the first cycle degree at home and not to seek credits for a 2nd degree
- checking the syllabuses of the four modules which were not accepted, the student realized that is able to complete them with good marks, being fully aware of the fact that failing to pass one subject would oblige him, under the rule of Erasmus mobilities, to pay back the full grant.

Unable to replace the four modules with other ones from the list pertaining only to the BEng and MEng programmes, but bearing no correspondence in the programme of the last two years of study in Bucharest, the student finally gave up the mobility.

Funding

In a top-down process such as the implementation of the Bologna process, it is almost certain that financial matters are also part of the agenda. The adoption of the two-tier system gave, indeed, a possibility of reducing the funding. In Romania, for instance, the number of students supported by the state budget who can be admitted to the 2nd cycle degree is limited to 50% of the graduates of the 1st cycle.

The fact that the funding is still based in most cases on allowances established per capita makes some universities to maximize the number of students, disregarding practically the needs of the labour market.

Accreditation

A great number of new engineering programmes have appeared in the last decade as a result of the Bologna process, at both university and non-university sector. The need of evaluation and accreditation of these programmes became stringent.

A response to this need are the EUR-ACE projects (EUR-ACE 2004 – 2006, EUR-ACE Implementation 2006 – 2008, EUR-ACE SPREAD 2008-2010).

The principal outcome of the first project EUR-ACE was the development of a "*Framework for the accreditation of engineering degree programmes in the*

European Higher Education Area". In the Foreword to the Framework Standards it is stated: "*The Framework Standards that have been developed and the procedure for their implementation are intended to be widely applicable and inclusive, in order to reflect the diversity of engineering degree programmes that provide the education necessary for entry to the engineering profession … Although the Framework is expressed in terms of accrediting degree programmes, it can be used for the accreditation of agencies that accredit (or in stend to accredit) engineering programmes, provided their rules and standards are consistent with the Framework (meta-accreditation).*"

The EUR-ACE Framework Standards [9] served as the basis for the award of a common European quality label, the EUR-ACE label.

The EUR-ACE project lead to the foundation in February 2006 of ENAEE (European Network for Accreditation in Engineering Education), open to all institutions/ organizations interested in matters of accreditation of engineering programmes and, in first place, to those which actually perform such accreditation. Among the founding members of ENAEE was UAICR (Union of Associations of Civil Engineers of Romania). In November 2009, ARACIS, the Romanian Agency for Quality Assurance in Higher Education, became also member of ENAEE.

After checking that producers and requirements applied by national agencies satisfy the EUR-ACE Framework Standards, ENAEE authorizes them to add EUR-ACE label to their accreditation. As for March 2010, seven national Agencies are authorized to award EUR-ACE label, namely: ASIIN (Germany), Engineers Ireland, RAEE (Russia), Engineering Council – UK, CTI (France), Order of Engineers (Portugal) and to MŰDEK (Turkey). It is expected that as a result of EUR-ACE SPREAD project, which will end in October 2010, EUR-ACE system will be implemented in several other countries: Italy, Lithuania, Romania, Switzerland.

Employability

Employability was a matter of no concern or little concern in the years when the traditional binary system prevailed in Europe and the labour market received (and welcome) the graduates of both long duration 5-year integrated programmes and short duration, practice oriented, programmes. However, this is no longer the case, in particular with respect to the new first cycle degree programmes. There are too few cohorts of graduates of these programmes for a correct assessment on how they were received and regarded by the employers. But one thing is certain: acceptance of the employers is more likely to be expressed for the graduates of the master degrees, either academic masters or professional masters.

Position of the professional associations

Among the partners of the EUCEET projects numbered, from the very beginning, the European Council of Civil Engineers, as well as most ECCE members, professional associations of civil engineers from different European countries.

In 2007, ECCE Standing Committee on Education and Training, chaired by Prof. Iacint Manoliu, launched a "*Survey among ECCE members on the changes induced by the Bologna process in civil engineering education in Europe*".

16 ECCE members (out of the total number of 22) answered to the survey, namely professional associations of civil engineering from Cyprus (North), Croatia, Estonia, Finland, France, Germany, Hungary, Latvia, Lithuania, Turkey, U.K.

There is no room here to present in its integrality the survey, with answers and questions. However, it is worth to comment some of the outputs.

The following answers were received regarding the opinion of the respective professional association for the solution adopted for transforming the integrated programmes in two-tier programmes:

- the solution is good: Latvia (4.5 + 1), Lithuania (4+2); U.K. (3+1)
- the solution is bad: Germany (3+2; 3.5+1.5); Latvia (3+2),
- the integrated programmes would be preferable: Finland (3+2); Portugal (3+2)
- it is too early to express an opinion: Croatia (3+2); Hungary (4+1.5); Slovakia (3+2); Slovenia (3+2); Romania (4+1.5)

Considering the solution adopted, the capacity of the graduate of the first cycle to demonstrate higher employability when applying for a job immediately after graduation was seen by the respective professional association as:

- non-existent (Portugal)
- very reduced (Germany)
- reduced (Slovakia, Slovenia)
- satisfactory (North Cyprus, Croatia, Estonia, Hungary, Latvia, Lithuania, Romania)

A few comments on the answers to these questions

In Latvia, the solution 3+2 adopted in 1996 was considered bad and replaced in 2003 with 4.5+1. In Germany, in the non-university sector (Fachhochshulen/ Universities of Applied Sciences) the programmes of 4 years duration, which included one semester of practical placement, were replaced by programmes of 3.5 years duration by simply cutting the semester of practical placement, completed by a professional master of 1.5 years. In Estonia, the solution 3+2

adopted in the 90's was replaced in 2002 by the old integrated programmes of 5-year duration.

As expected, capacity of the graduates of the first cycle to demonstrate higher employability when applying for a job after graduation was considered satisfactory only in the countries where the first cycle has a duration of at least 4 years, with the exception of Croatia where is of 3 years duration.

A final question of the survey was formulated as follows:

"*Have been consulted professional associations from your country, including your organization, by the authorities implementing the Bologna process when decisions to reform higher education were adopted*?"

Here are the results:

- no consultation at all: Romania, France;
- very little consultation: Croatia, Finland, Lithuania, Slovakia;
- good consultation: Estonia, Germany, Hungary, Latvia, Portugal, Slovenia

At the survey did not participate the Italian member of ECCE, "*Consiglio degli Ingegneri*". However, as previously shown when referring to the presentation made by Prof. Squarzoni at the CLAIU-EU Conference "*Engineering Master Degrees in Europe*", the "Consiglio" is strongly advocating the return to the 5-year integrated programme, which means that is not in favour of 3-year first level degree.

Mobility of professionals

Issues tackled in the previous paragraphs are related to the *professional recognition* which is a key factor for the mobility of professionals.

Rules for professional recognition were defined in the European Directive 2005/36/EC. The Directive shows that "*to promote the free movement of professionals, while ensuring an adequate level of qualification, professional associations should be able to propose Common platforms at European level … A Common Platform is a set of criteria which make it possible to compensate for the widest range of substantial difference which have been identified between training requirements in at least 2/3 of the Member states. These criteria could include additional training, an adaptation period under supervised practice, an aptitude test or prescribed minimum level of professional practice, or combination of them.*"

Article 11 of the Directive stipulates five different levels of formal qualifications which must be recognized, expressed in diplomas certifying the successful completion of a post-secondary course at a university or other institution of higher education for a defined duration, as well as the professional training which may be required in addition to the post-secondary course. The

most common of these are diplomas of at least 3 and not more than 4 years and diploma of at least 4 years.

The civil engineering professions is regulated in a number of European countries, such as Portugal, Spain, Italy and Greece, where a professional civil engineer must be recognized and registered with a competent authority (ministry or professional association) to be able to practice.

In non-regulated countries, any person having the formal qualification may practice as a civil engineer. However, some of these countries have protected titles for their professional engineers and, hence, they are considered for the purposes of the application of the European Directive as "*partial-regulated*" countries.

One way to obtain the *professional recognition* is to get first the *academic recognition,* by which is meant the acknowledgement by a competent authority of a higher education institution of the academic qualification as an indication of the capabilities obtained in a study programme or part of it. Due to the unavoidable differences between the programme graduated by the candidate in his/her country and by the one offered in the host country, a *direct recognition* is rarely issued. It is true that since the introduction, several years ago, of the "*Diploma supplement*", the process has been eased, but the problem of the differences remains and must be solved.

According to the European Directive, a civil engineer who is professionally qualified to work in one Member State, must apply for recognition of his/her professional qualification to the competent authority if wants to work in a regulated country. This authority must asses the equivalence of the engineer's formal qualifications and professional experience against their requirement for registration and invite the applicant to provide information concerning his/her training in order to determine the existence of potential substantial differences with the required national training. If such differences are identified, the competent authority must offer the applicant either an adaptation period or an aptitude test. The adoption period is a period of up to 3 years of supervised practice in the host country and must have a final assessment. The aptitude test shall cover a list of subjects not found in the candidate qualifications but required in the host country.

Differences in the duration of studies and curricula between the diploma in the country of the candidate and the one in the host country, make very difficult for the candidate to acquire a total professional recognition through an adaptation period or an aptitude test. Namely these differences among qualifications of civil engineers in various countries of Europe explain why all attempts to establish a Common Platform for civil engineers have so far failed and so will do in the future.

A possible solution was found in Portugal and bears the name of "*Partial Recognition*". According to the Law 9/ 2009, an adoption for Portugal of the European Directive 2005/30/CE, besides the recognition procedures described in the Directive appears also the possibility of a "*Partial Recognition*" in

situations when the candidate has qualifications which cover only part of the qualifications required by the profession in the host country.

The idea of "*Partial Recognition*" is at the base of a "*Professional recognition recommendation*" formulated by the ECCE Standing Committee on Professional Recognition & Mobility chaired by Prof. Fernando Branco (Instituto Superior Tecnico Lisbon) and presented at the 50th ECCE General Meeting in Helsinki, on 16-17 October 2009 [10].

Concluding remarks

The Bologna process brought great changes in the European civil engineering education area. The most important change is, without any doubt, the advancement of the two-tier system which became prevalent in less than a decade. New programmes were built at both first and second cycle degrees.

Solutions adopted for the transformation were diverse, but very much influenced by the traditions and conditions in the country in which they were introduced. Of particular relevance is the introduction in some institutions of master programmes in disciplines for which no degree was previously offered.

An important development is represented by the introduction of master programmes in institutions belonging to the non-university sector. In fact, by being able for the first time to offer Ba-Ma programmes, these institutions appear to be the main beneficiaries of the Bologna Process.

One cannot avoid recognizing that among the stakeholders, the representatives of the professional world seem to be the less content with the new architecture of the higher education system. Quite often they show concern about the disappearance from the offer of universities of the long duration, 5-year integrated programmes, considered as a true landmark of European civil engineering education.

Speaking on the skepticism or even reluctance of the professional world in respect to the transformation produced by the Bologna Process, seen by them as a "top-down" politically motivated process, seems appropriate to observe that engineering (including civil engineering) is perhaps the only professional discipline in which is taking place the implementation of the new degree structure, unlike the situation in other professional disciplines such architecture, medicine, dentistry, pharmacy, veterinary medicine. It is true that all these disciplines represent at European level "*regulated professions*".

It is too early to properly assess the results of the implementation of the Bologna Process on civil engineering education in Europe.

To conclude in a more optimistic note, the author will quote from his paper published in the fourth EUCEET volume in 2004: "*Let's hope that, through the active involvement of all stakeholders, academics in first place, students, professional associations, industry, public authorities a.s.o., the results will lead to a stranger and more competitive European civil engineering education*".

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ANNEX I

Papers presented at the **Workshop**: “The new first cycle degree programmes in civil engineering in Europe: problems and solutions”

Santander, 16th March 2007

IMPLEMENTATION OF THE TWO-TIER STUDY PROGRAMMES IN CIVIL ENGINEERING EDUCATION ACROSS EUROPE, FOLLOWING THE BOLOGNA PROCESS: STATE-OF-THE-ART IN BULGARIA

Gospodin Gospodinov[1]

1. GENERAL*

At present there are three Higher Education Institutions in Bulgaria where Civil Engineering faculties are available, namely: University of Architecture, Civil Engineering and Geodesy (UACEG), Sofia, Higher School of Civil Engineering "Lyuben Karavelov" (HSCELK), Sofia and Free University "Chernorizets Hrabar" (FUCH), Varna. In all of them the most popular course (speciality), called *Civil Engineering Structures* is presented, so we shall limit our revue and analysis on it.

In 1995 a new Bulgarian Higher Education Act was introduced. The most important article was that: *…within three years the Bulgarian Universities are supposed to…* shift from the classical one-tier 10 semesters system (leading to a single diploma in Civil Engineering for UACEG), to the two-tier system – Bachelor and Master (BSc and MSc). For BSc courses minimum of 8 study semesters were envisaged, whereas for MSc – 3 (including master's thesis). It was mentioned in the Act, however, that in some cases it would be possible to keep the present one-tier programmes unchanged.

Most of the Universities begun working on this big change of the system and the process was not smooth and easy, especially for the Technical Universities. A radical change of the existing curricula was necessary in order to create broad-profiled BSc programmes within 8 semesters and few narrow specialized MSc programmes, covering all fields required from the industry. It was even reported that a state of *chaos* was reached in some Universities when pursuing those changes. It is the author's belief now that in most Universities the difficulties have been overcome and the present-day situation is much better.

It was very interesting to observe how the processes of changes have developed in UACEG, which in 1995 it was the only University educating civil engineers for the Bulgarian industry. In 1997 the Academic Council decided that the two-tier system is not suitable for UACEG. It was declared that the quality of education in engineering faculties is good enough to be equivalent to

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* In this short report we shall concentrate our analysis on the three Higher Education Schools, namely UACEG, HSCELK and FUCH, where Civil Engineering faculties are available. In particular, we shall target the most popular course (speciality), called *Civil Engineering Structures.*

master's degree in European sense. As a result, we kept the system and curricula unchanged and named our graduates *Masters*.

Meanwhile, after 1995 as a result of the ongoing political and structural changes in Bulgarian society two other Universities have opened Civil Engineering faculties: HSCELK (former military higher education school) and the new established private Free University in Varna-FUCH. Although these two institutions have copied the curriculum of the course *Civil Engineering Structures* from UACEG, they have developed their own strategy and educational politics, which included the implementation of the two-tier system. We shall give brief comment on the educational structure and the main features of the curricula of the above three Universities.

To be able to usefully discuss and compare the basic features of the study programmes in Structural Engineering for the three aforementioned Universities, all the subjects have been organized into five clusters, as follows [1, 2, 3]:

1. *General Sciences*: basic subjects such as mathematics, physics, mechanics, chemistry, geology, statistics…etc;
2. *Engineering Sciences*: such as structural mechanics, theory of structures, concrete structures, steel structures, material science, structural technology, architectural engineering, highways, traffic engineering, soil mechanics, fluid mechanics…;
3. *Design and Planning*: structural design, building planning and design, design of bridges, tunnels and harbours, public transportation, traffic planning…;
4. *Engineering Skills*: computing, programming, drawing, communications, project education, surveying, personal development, CE teamwork, geology field work, construction site practice…;
5. *Miscellaneous*: languages, introductory courses in CE, environmental science, historical aspects of CE, the social contents of CE, technical economics, social science and management….

It is clear that the above classification is too rough and the comparisons based on it can only lead to a broad statement. For example: the degree of liberty in choosing elective courses outside the compulsory courses is too great; the site practice and field works are not present in certain curricula ... etc.

2. UNIVERSITY OF ARCHITECTURE, CIVIL ENGINEERING AND GEODESY (UACEG), SOFIA

The University of Architecture, Civil Engineering and Geodesy, Sofia was established in 1942 and until 1995 was the only educational institution training civil engineers. There are 5 faculties in UACEG, namely: Faculty of Architecture, Faculty of Structural Engineering, Faculty of Hydrotechnics, Faculty of Transportation Engineering and Faculty of Geodesy. At present the

total number of the students entering UACEG is about 600 per year, of which about 200 are the students commencing their study at the Faculty of Structural Engineering.

The Faculty of Structural Engineering offers two specializations after 8th semester: (1) Structures; (2) Technology. The Faculty of Hydrotechnics offers three specializations after 8th semester: (1) Irrigation and Drainage; (2) Hydraulic Structures; (3) Water Supply and Sewerage. The Faculty of Transportation Engineering offers two specializations after 8th semester: (1) Road Construction; (2) Railway Construction. It is fair to say that the study programmes in these faculties, although not fully identical, are very close for the first 4 years. Our conclusion is that more or less we follow the principles of the two-tier degree system without clearly stating that and without providing the students with the intermediate BSc diploma.

Course analysis of the one-tier programme "Civil Engineering Structures"

For the first 9 study semesters the average contact hours are about 30 h/week for the compulsory subjects and compulsory elective subjects, excluding field work, on site practice and sport. The 10th semester is reserved for the preparation and defense of the diploma thesis project – we put on the average 30 classes per week.

In Table 1 below we give in percentage the relative portion of the various cluster subjects for the *Civil Engineering Structures* programme in the UACEG. In order to appreciate the importance of the diploma thesis work, we make two types of calculation: with and without its contribution.

We shall leave some findings and conclusions for the later phase, when similar tables are enclosed and comparisons are made for the same study programme for other two Universities – HSCELK and FUCH. It is instructive to define two measures: k1 – the sum of (1+2) clusters as a generalized measure of the *core engineering subjects* ; k2 – the sum of (3+4+5) clusters as a generalized measure of the *additional engineering subjects*. The ratio of these two coefficients is an interesting number showing how *broad* or how *narrow (or specialized)* the programme into consideration is. For the case of the single-degree study programme for UACEG from Table 1 we have: k1=69, k2=31 (diploma thesis excluded) and k1=62, k2=38 (diploma thesis included).

Table 1. One-tier 10 semesters programme in UACEG, Sofia

	General Sciences	*Engineering Sciences*	*Design and Planning*	*Engineering Skills*	*Miscellaneous*
Thesis not included	20 %	49 %	5 %	14 %	12 %
Thesis included	18 %	44 %	12 %	14 %	12 %

3. HIGHER SCHOOL OF CIVIL ENGINEERING "LYUBEN KARAVELOV" (HSCELK), SOFIA

Since 2000 the former Construction Military School was demilitarized and renamed into Higher School of Civil Engineering "Lyuben Karavelov" with status of State higher educational school. It provides full-time regular and part-time forms of education for all educational degrees – BSc, MSc and PhD. To facilitate the analysis we shall concentrate on the major engineering speciality which is very similar to *Civil Engineering Structures* in UACEG.

For the educational degree *Bachelor* a full-time course is offered for 4 academic years (8 semesters) and a part-time course for 5 academic years (10 semesters). The total number of students entering this first degree program is about 150 per year. After getting the BSc diploma the students are offered a full-time *Masters* program - 1,5 academic years (3 semesters including MSc thesis) called *Structures*. Such course started for the first time in the academic year 2005-2006 recruiting a batch of about 50 students.

Course analysis of the BSc programme "Civil Engineering Structures"

For the first 8 study semesters the average contact hours are about 26 h/week for the compulsory subjects and compulsory elective subjects, excluding field work and site practice. After 8th semester the students are supposed to prepare and defend the diploma thesis project – we put on the average 26 h/week.

Table 2. BSc 8 semesters programme in HSCELK, Sofia

	General Sciences	*Engineering Sciences*	*Design and Planning*	*Engineering Skills*	*Miscellaneous*
Thesis not included	21 %	41 %	6 %	17 %	15 %
Thesis included	18 %	37 %	14 %	16 %	15 %

Calculating again the measuring coefficients in Table 2, we get the following results: k1=62, k2=38 (thesis excluded), and k1=55, k2=45, (thesis included).

4. FREE UNIVERSITY "CHERNORIZETS HRABAR" (FUCH), VARNA

The Free University "Chernorizets Hrabar" was established in 1991, but since 1995 the University was given the status of a higher educational institution. It provides full-time regular and part-time forms of education for all educational degrees – BSc, MSc and PhD. Again we shall analyze the major engineering speciality which is very similar to *Civil Engineering Structures* in UACEG and HSCELK.

For the educational degree *Bachelor*, a full-time course is offered for 4 academic years (8 semesters) and the total number of students entering this first degree program is about 100 per year. In principal, the students are offered a full-time *Masters* program – 1,5 academic years (3 semesters including MSc thesis) called *Structures*, but this course is under preparation and has not started yet.

Course analysis of the BSc programme "Civil Engineering Structures"

For the first 8 study semesters the average contact hours are about 27 h/week for the compulsory subjects and compulsory elective subjects, excluding field work and site practice. The respective coefficients can be seen in Table 3 for the case when the contribution of diploma thesis is not included: k1=62, k2=38 – full coincidence with the similar coefficients for HSCELK. For lack of reliable data for the contribution of the diploma thesis, we accept that the coefficients k1 and k2 are similar to the case of HSCELK.

Table 3. BSc 8 semesters programme in FUCH, Varna

General Sciences	*Engineering Sciences*	*Design and Planning*	*Engineering Skills*	*Miscellaneous*
23 %	39 %	4 %	16 %	18 %

It is interesting to point out that the relatively high percentage for the *Miscellaneous* cluster in Table 3 is due to the fact that the foreign languages are quite well present in the curriculum (4 semesters), as well as the sport activities during the whole course.

5. SOME CONCLUSIONS

Due to space limitation, only the observations of major importance are enclosed here:

1. Firstly, we make the assumption that coefficients k1 and k2 for the case of the two BSc curricula (HUCELK and FUCH) are typical for such *broad-profiled* study programs;
2. The one-tier study programme *"Civil Engineering Structures"* in UACEG, although being considered as a *broad-profiled*, does not have the typical features of such a programme. It can, however, serve as a basis for the creation of a new BSc programme;
3. The situation is even worse as far as the other two Engineering faculties (Hydrotechnics and Transportation Engineering) of UACEG are concerned, since their curricula are more narrowly specialized;
4. Therefore, the best solution is to elaborate a single unified BSc programme for the above three faculties called *Civil Engineering*. Provided that task is

accomplished, the MSc specializations are comparatively easy to be developed.

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FIRST EXPERIENCES WITH THE IMPLEMENTATION OF THE 3-TIER „BOLOGNA SYSTEM“

Václav Kuráž [2]

1. INTRODUCTION

1. Brief information about CTU in Prague

1.1. History: 1707 – Restrict of Joseph I.
1803 – Prague Polytechnic
1879 – Technical University
1920 – Czech Technical University

1.2. Faculties:

	Number of Students
• Faculty of Civil Engineering	6568
• Faculty of Mechanical Engineering	4279
• Faculty of Electrical Engineering	7005
• Faculty of Nuclear Sciences and Physical Engineering	1795
• Faculty of Architecture	1528
• Faculty of Transportation Sciences	1864
• Faculty of Biomedical Engineering	337

Note: Number of students in the academic year 2006/07

2. Education system

- Since 2004/05 CTU offers following study programmes: 15 Bachelor programmes (47 branches), 25 Masters programmes (126 branches), 9 PhD. Programmes (52 branches)
- Faculty of Civil Engineering - until academic year 2002/03 offered an Engineering education lasting five and a half or six full study years, divided into so-called “study stages” – the first “stage” was the first 3 years.
  - Since 2003/04, a system with a 4-year bachelor programme, plus a one-and-a- half or two-year master programme has been applied.

Table 1. Comparison of the study systems at different faculties of CTU in Prague

Faculty	Study System
Mechanical Engineering	4 yrs +1,5 yrs
Electrical Engineering	3 yrs +2 yrs
Nuclear Sciences and Physical Engineering	3 yrs +3 yrs (2 yrs)
Architecture	3 yrs +2 yrs
Transportation Sciences	4 yrs +1,5 yrs
Biomedical Engineering	3 yrs +2 yrs

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Reasons for the anomalies

- Study programmes are designed at faculty level
- Some professional organisations indicated that they would give no recognition to 3-year bachelor programmes
- No national guidelines were set by the Ministry
- Universities are funded mainly per head of student, and have an incentive to maximize the numbers of registered students.

Bachelor study programmes

- *Civil Engineering*
  - Building Structures
  - Structural and Transportation Engineering
  - Water Management and Water Structures
  - Environmental Engineering
  - Management and Economics in the Building Industry
  - Information Systems in the Building Industry
  - Material Engineering
- *Geodesy and Cartography*
  - Geodesy and Cartography
  - Geoinformatics
- *Architecture and Building Engineering*
  - Architecture and Building Engineering
- *Civil Engineering* - in English
  - Building Structures

Master study programmes 1.5 or 2 years
(opened from October 2007 for students with a bachelor degree)

- *Civil Engineering*
  - Building and Structures
  - Structural and Transportation Engineering
  - Water Management and Water Structures
  - Environmental Engineering
  - Management and Economics in the Building Industry
  - Project Management and Engineering
  - Information Systems in the Building Industry
  - Materials Engineering
- *Geodesy and Cartography*
  - Geodesy and Cartography
  - Geoinformatics
- *Architecture and Building Engineering*
  - Architecture and Building Engineering

  Buildings and Environment

- Buildings and Environment
- *Civil Engineering* - in English
  - Building Structures
  - Computational Engineering in Advanced Design

  Buildings and Environment - in English
  - Buildings and Environment

Table 2. Number of applicants and accepted students

Academic year	No. of applicants	Accepted	Enrolled
2002/03	3090	2000	1507
2003/04	3176	2034	1567
2004/05	3262	2147	1608
2005/06	3165	1978	1450
2006/07	2856	1754	1307

Table 3. Number of enrolled students in different semesters – study program Civil Engineering – Students accepted and enrolled in the 1st semester, academic year 2003/04

Semester	1st	2nd	3rd	4th	5th	6th	7th
Number of students	1123	921	719	623	553	526	479
%	100	82	64	55	49	47	43

3. MAIN ADVANTAGES AND PROBLEMS - COMPARISON WITH THE PREVIOUS SYSTEM

3.1 Advantages

The new system allows students to move more easily from one study branch or study programme to another. The master programs are more specialized than the bachelor programs. The new system is much more flexible.
New Technical Higher Education Institutions have been set up throughout the Czech Republic. They will be offering bachelor level study programmes. We expect the number of BSc students in these institutions will increase (partly because it will be cheaper for students to study nearer to home or living at home). The best graduates will then be able to continue in an MSc programme offered at a Technical University.

3.2 Problems

The main problem seems to concern student mobility. The strategy of CTU concerning study abroad is as follows:

- Bachelor study programmes: according to the requirements of the ERASMUS program – after successfully completing of the first study year it is possible to study abroad.
- Master Study: It is recommended to study at least one semester abroad.
- Doctoral Study: at least 3 months of study abroad is obligatory

3.3 Main obstacles

- **Bachelor Studies:** The 3rd study year seems to be the best for exchange. In general students are able to find courses both from the 3rd and 4th study year and then after they return back they are able to complete the courses from the 3rd and 4th study years. There are problems mainly in universities having only MSc. study programs taught in English. In this case, the number of exchange students is limited.
- **Master Studies:** The semester abroad is recommended, but at present the BSc. state examination can be taken only in September. Most graduates go straight on to their master's studies. It difficult to plan a period of study abroad when there is still some uncertainty about whether the student will complete her/his bachelor programme, and when the BSc state exam takes places after the beginning of the new semester at some of our partner universities. This could mean that most students will consider only one semester – the spring semester of the first year of the master programme - to be convenient for studying abroad.
- **Doctoral Study:** 3 months study abroad is obligatory. There are problems to find a supervisor at a partner University, and there are also problems concerning the comparability of research performed at the partner university. These obstacles can only be overcome by close cooperation between supervisors at the home university and abroad.

4. PROPOSALS

It might be useful to develop a network of Civil Engineering Faculties that have bilateral agreements with each other. Each partner will propose one or two exchange semesters with approximately 20 ECTS credits for obligatory fixed courses (both for BSc. and MSc. levels). If the "exchange semester" is confirmed by both partners, students will add further optional, professionally oriented courses that will take the total number of credits to 30 for the semester), and the semester will be fully recognized at the student's home university.

The inclusion of practical placements in the new LLP program (ERASMUS) will help us to find more opportunities for exchanging doctoral students.

EXTRACT FROM POSITION PAPER [1] CONFIRMED BY THE FAKULTÄTENTAG (BOARD OF FACULTIES) REPRESENTING CIVIL ENGINEERING AND GEODESY

Peter Ruge[3]

1. INTRODUCTION

The Fakultätentag (board of faculties of civil engineering and geodesy) represents 25 faculties in german-speaking regions in Germany, Austria and Switzerland.

In a series of declarations, the Fakultätentag expressed its opinion concerning the implementation of the Bachelor/Master system. In what follows, the essentials of these declarations are summarized.

The 61st plenary assembly of the Fakultätentag took place in Vienna from 29th of September to 1st of October 2004.

In order to support the complete and efficient realisation of the goals set by the Bologna process within the scope of the European university system, and meeting their responsibilities, the members of the Fakultätentag agreed on the following conceptual framework outlining the features of Bachelor - and Master study courses* of civil engineering.

Essential conceptual framework

The civil engineering study course at "Fachhochschulen" and at universities has proved effective on a national and international scale. It meets the manifold requirements set by science, trade and industry and administration bodies and has been adapted to the skills and talents of students. The course profile offered by the universities is research - and practice-oriented and is based on broad scientific knowledge combined with exemplary advanced studies. The university study course aims at enabling graduates to extend established knowledge of theory and application by newly found approaches and methods, to tackle problems as they arise and pursue their solution and to work on innovative results. To meet these demanding goals, students have to be integrated into research work at an early stage. It is the only way to make students develop the expertise needed to find creative approaches in research

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* Notice: in Austria Master Course is called Magister course and Bachelor Course is called Bakkalaureats Course

and to implement them in the field of civil engineering. It is an additional aim of the course to encourage the formation of personality and communication skills.

The general conditions outlined by the Fakultätentag aim at maintaining the traditional and successful double-track system and at developing it within the Bologna process in order to ensure its international compatibility. Contents and structures of the course are therefore continually adapted to this end. In this endeavour, the Fakultätentag closely cooperates with the representatives of the economy and boards of administration (such as construction industry, consulting engineers, public authorities, boards of engineering, and professional associations).

Along the lines of this concept, the course is both basics-oriented and career-related. The Fakultätentag has therefore agreed on supplementing the traditional single-tier Diplom course for civil engineers by introducing the option of a consecutive university Bachelor-Master course study on the basis of the following principles[**]:

1. The course's table of contents, relevant for civil engineering, is being mirrored in the consecutive Bachelor-Master study courses, in order to safeguard the high quality of the course regarding the varying job profiles required in the fields of science, economy and administration. This also applies to the division of responsibilities between the Fachhochschulen and the universities regarding the training of civil engineers.

2. In order to ensure transparency of the course system, interface schemes for a smooth transition between different course options are being provided for and orientation guidelines and counselling will be prepared.

3. Since civil engineers with a university degree take on great responsibility in society and industry for the development, organisation, security, profitability and the ecological compatibility of infrastructure and construction facilities, the regular duration of studies of 10 semesters is the minimum required to obtain full professional qualifications[***].

4. It is therefore intended to introduce the Master of Science as a regular study course degree at universities and technical universities. It corresponds with the scientific standards of the Diplomingenieur and qualifies him for any professional career in civil engineering.

[**] For study courses with trimester arrangement (universities of the Federal Forces) it is accepted to supplement the Diplom course for civil engineers by a single-tier Master study course

[***] This fact is also underlined by the current developments within comparable course systems in Anglo-saxon universities.

5. The Bachelor course of studies aims at the transfer of scientific, general engineering and broad methodical bases as well. The successful student graduates with a Bachelor of Science degree.
   The Bachelor of Science serves as a kind of hub offering students at this stage a choice of various options, such as
   - consecutive continuation of studies in a Master course
   - Master course in the same subject but at an international university
   - Master course in a related or complementary subject or
   - start of a professional career with the obligation to pursue further qualification by on-the job training.

6. To reach the above goals, a minimum of 6 semesters is generally required for the Bachelor course (including the Bachelor thesis). An alternative model of a 7-semester Bachelor course is taken into consideration. This flexible interface scheme is also meant to facilitate and promote exchange programmes with other universities, on a national and international level.

7. The envisaged organisation of the Bachelor course also allows after the first 3 semesters to evaluate at an early stage the individual perspectives for successful graduation. For this purpose, it is recommended to introduce an accompanying mentoring scheme, if possible.

8. For the immediate follow-up study course after Bachelor graduation a consecutive 4-semester Master course (including the Master thesis) will be set up. (For the 7-semester Bachelor model, a 3-semester Master course correspondingly).
   In fact, the interface scheme offers flexible access to the Master study course for externally, nationally or internationally obtained Bachelor degrees. Admission to the Master course is the responsibility of the respective faculty. Restrictions for the transition from university Bachelor to a consecutive Master course are not allowed.
   Financial support of the Bachelor and Master courses should be basically guaranteed.

9. Students are tutored and selected in such a way as to ensure that they are generally positive about and able to finish the Master course successfully.
10. To counteract prolonged duration of studies, students with advanced potential have the opportunity to take courses of the Master courses at their home university already before their Bachelor degree if a successful graduation is foreseeable.

11. Formal admission to doctoral studies is generally granted on the basis of excellent results of Master or Diplom degrees.

Study course Set-up

As to the technical organisation of the Bachelor/Master study course we advise the following structuring:

- Bachelor degree consisting of basic and specialized courses
- Master degree structured as science-oriented major subject course which offers introduction into technological and scientific research in specialized fields

Selection procedures for Bachelor courses will be carried through before the beginning of courses or during the first 2 to 3 semesters. Selection criteria for the admission to the Master course for candidates of other faculties will be determined by each individual faculty and may require admission tests, if necessary.

The present conceptual framework defines a rough outline of civil engineering course studies of all member faculties. It has been established in order to ensure the quality of academic training on a high scientific level and to allow for the students' uncomplicated transition between different universities without time delay. Within the process of creating a distinct profile of its own for each individual university, sufficient scope for major subject concentration and competition among each other is allowed for. With a view to professional practice the concept at hand sets the necessary standards for a broad bases-oriented civil engineering education including the required range of subjects and it creates the transparency essential for career entry in the fields of economy and administration.

Apart from this study programme, it goes without saying that further specialized and more compact study courses may be offered that are asked for by growing international market demands. Yet, these additional courses are not acknowledged by the Fakultätentag as university civil engineering degrees.

Goals and Contents of Study Courses

It is the goal of the civil engineering course to create a sufficiently broad civil engineering basis including exemplary in-depth specializations,

- that qualify students to find sustainable solutions for civil engineering tasks
- that promote communication skills within and among related departments
- that improve team work skills for cooperative solutions within networked civil engineering procedures
- that provide basic knowledge of social sciences, economics and law
- that create a stable basis for lifelong independent learning
- and that safeguard the civil engineer's ability to meet her/his social responsibility.

The university-graduated Bachelor of Science in Civil Engineering has to have the following qualifications:

- founded knowledge of scientific civil engineering basics such as mathematics, technical mechanics, material science and of basics in physics, chemistry and geology.
- broad basic knowledge of the core subjects of civil engineering such as: construction management, geotechnics, infrastructure systems, design, numerical methods and computer science, ecological systems and environmental technology, statics, dynamics, transportation, hydro engineering.

The university-graduated Bachelor of Science has gained a first elementary qualification regarding a civil engineer's career. Furthermore, he is obliged to continually qualify on-the-job. A thorough professional training, however, that enables university-trained engineers to tackle in a highly responsible way the sophisticated tasks of safeguarding the functions and safety in our social community, requires a minimum of a 10-semester standard period of study[****].

The University-graduated Master of Science in Civil Engineering in addition has to have the following qualifications:

- advanced special knowledge in two to four civil engineering subjects including their theoretical bases, scientific methods and their fields of application
- the capability of systematically extending established technical knowledge, analyzing and formulating processes from a general point of view and to challenge them critically.
- the ability to implement in a competent way research and development tasks and to take on any kind of professional challenge.

It is a special quality feature of the University Master study course to introduce students to the current level of research and development, i.e. by integrating them into ambitious research projects or the handling of innovative application-related tasks. Students are encouraged to work largely independently and take on responsibility.

2. DECISION

The above general conditions worked out on the basis of the established references have been unanimously agreed upon by the members of the 61st

[****] These criteria are also applicable for university study courses in geodesy and for the trimester regulations in the Federal Forces University

plenary assembly of the Fakultätentag, representing civil engineering and geodesy, in Vienna on the 30th of September 2004.

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HUNGARIAN BSc-MSc PROGRAM AFTER JOINING THE EU

Antal Lovas[4]

SHORT ABSTRACT

The Faculty of Civil Engineering is the oldest faculty of the Budapest University of Technology and Economics. It was established in 1782 as the Institutum Geometricum Hydrotechnicum.

The curriculum went through several reforms in the past 227 years and it has changed significantly as a result of the Bologna Process. The following table contains the three levels created, including a short description of their target areas.

Table

Program	Credits	Target Area
Basic Program	BSc, 240 credits	Construction, Operation, Maintenance, Basic Design
Masters Program	MSc, 90 credits	Senior Design, Consulting, Development
PhD Program	PhD, 180 credits	Research, Education, Development

In the Basic Program students may choose between the structural, infrastructural and geoinformatics branches of civil engineering. It is followed by three independent Master's Programs: Structural Engineering, Infrastructural Engineering, Surveying and Geoinformatics. Continuing education is available for both programs. An MSc degree is required for entering the PhD program.

1. INTRODUCTION

The distinctive feature of the Civil Engineering profession is that all of society sees and uses it's products (buildings, roads, railroads, bridges, water supply and sewer systems, waterworks, river regulations, and flood control, waste disposal etc.) every day. Civil Engineers might have the greatest responsibility of all engineers; minor engineering mistakes may endanger people's lives. Civil Engineering activities have the strongest affect on nature

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and practically every one of their creations is unique. They play a major role in preventing disasters caused either by nature or man.

According to the 10-20 year projection, the present infrastructural and residential needs in Hungary will produce a steady demand for Civil Engineering. There are many Civil Engineering enterprises, which exist on several continents; this trend is increasing with the spread of globalization. There has been a need, and probably will be one in the future, for creative, highly trained Civil Engineers who speak foreign languages, have good computer knowledge, and are good team workers.

2. THE PRESENT STATE AND HOW IT DEVELOPED

In Hungary the requirements for entering higher education are 12 years of elementary and high-school education and passing the high-school graduation exam. According to the continental educational system the university program is five years long.

The Faculty of Civil Engineering is the oldest faculty of the Budapest University of Technology and Economics. The curriculum went through several reforms in the past 227 years. The following changes were the most important:

In the mid 1960's the program was organized into four branches:

- Transportation Engineering,
- Structural Engineering,

- Hydraulic and Water Resources Engineering,
- Surveying.

The integrated civil engineering program was introduced in 1992, during the next two years the following branches were introduced along with the credit system:

- Civil Engineering and
- Surveying and Geoinformatics branches.

After examination of the early anomalies of the credit system (25 groups of final exam classes, as much as 150 final exam classes, more than 120 optional classes etc.) we introduced the system of specializations (12 majors) in 1998 in accordance with the Chamber of Engineers. Further corrections to the so called "ÉPÍTŐ2000" program were then introduced, which consist of branches (structural engineering, infrastructural and environmental engineering branches and the now independent surveying and geoinformatics branch). Under the new system the first three semesters are identical; students have to specialize after the third semester. This allows students to learn the profession and the different faculties at higher level.

This did not conclude the development of our program. In 1998 we joined to the European Civil Engineering Education and Training Thematic Network project; we prepared the assessment of the European engineering education, and started the preparations for switching to the two cycle program. The „four year" 240 credit BSc Civil Engineering program was accredited by the Hungarian Accreditation Committee in 2003, and the program started in 2005. The new curriculum is based on the "ÉPÍTŐ2000" program, keeping its structure and most of the mandatory classes.

Every year the number of applicants and the number of points required to be accepted gets higher on the faculty. The dropout rate is quite high for both state-funded and self financed students as well. For the average student it takes over six years to graduate.

3. THE BSc BASIC PROGRAM

The goal of the program

The goals of the BSc basic program are the following: to train well prepared Civil Engineers who speak languages, are capable of performing the tasks of construction, operation and maintenance, contracting and working for the authorities, solving design and simple development tasks according to their training, taking part in more complex design projects. The designer titles described by the regulations can be obtained after the required time of practice

within the field's branch of graduation. First Cycle is leading to a degree that is competent at the "labor market", as required by the Bologna Declaration.

The new 240 credit "Civil Engineering" basic program replaces the current university level Civil Engineering, GIS Engineering, Municipal Engineering and the college level Civil Engineering, Municipal Engineering and parts of the Environmental Engineering (water environment, waste management, problems of built environment, etc.) programs.

Determining the common basic curriculum

In 2003/2004 a survey and a recommendation was prepared about the mandatory basic curriculum of Civil Engineering within the SP1 group of EUCEET (European Civil Engineering and Training). In several cases there were significant disagreements between the participants concerning the determination of the groups of classes. At the evaluation of the survey, the extreme values were mathematically filtered out and the average was given.

In the table 1 are given, for comparison, the number of credits in the proposal formulated by EUCEET and in the curriculum adopted in Hungary.

It was shown that the size of our basic curriculum (136 credits) is practically the same as the recommendation. We are teaching a lot more surveying, geotechnics and economics and management than the recommendation based on the survey indicates.

Table 1.

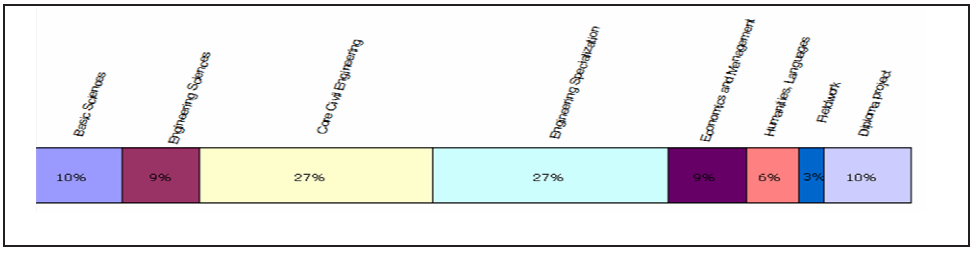
Core subjects in curricula for Civil Engineering		**Proposal**	**Hungary**
SUBJECTS	**Problems Included**	**Credits**	**Credits**
Mathematics and Applied Mathematics	Particular branches, e.g.: Linear Algebra, Probability and Statistics, Mathematical Analysis, Numerical Methods	16,0	16
Applied Chemistry	Chemistry of building materials, ….	3,0	2
Applied Physics	Heat and Humidity Transfer, Acoustics, Electrotechnics,…	5,5	3
Computer Science and Computational Methods in C.E.	Introduction to Computer Science, Basis of computer programming, Operating basic programs (ACAD, MathCad, GIS)	6,5	6
Drawing and Descriptive Geometry	Hand drawing (sketch)	4,0	4
Mechanics	Continuum mechanics, Solid mechanics,…	5,5	3
Mechanics of Materials	Strength of materials, Elasticity, Plasticity	7,5	5
Structural Mechanics	Statics, Dynamics,	8,5	7
Fluid Mechanics & Hydraulics	Fluid mechanics, Hydraulics,	5,5	6
Engineering Surveying	Geodesy,	5,0	13

Core subjects in curricula for Civil Engineering		**Proposal**	**Hungary**
SUBJECTS	**Problems Included**	**Credits**	**Credits**
Building Materials	Building materials, Road materials, Concrete Technology,…	5,5	3
Buildings	Basic rules of buildings design in view of their structural reliability, exploitation quality, construction and economy with reference to building materials and physics as well as to the basic knowledge of structural systems.	4,0	3
Basis of Structural Design	Loads, Reliability of structures, Design Codes, Conceptional Design of Structures,…	4,5	2
Engineering Geology		3,5	3
Soil Mechanics and Geotechnical Engineering		6,5	11
Structural Concrete	Reinforced concrete, Prestressed concrete	7,5	4
Steel Structures		6,0	3
Timber, Masonry and Composite Structures	Timber structures, Masonry structures, Composite structures (steel-concrete, timber-concrete,…)	3,5	3
Transport Engineering	Roads, Highways, Urban communications, Technology and management of transport. Railways, Bridges,...	4,0	6
Urban Planning		3,0	4
Water Structures and Water Management	Fundamentals	3,5	4
Construction Technology & Organisation	Building technology, Organization of building site,…	5,5	5
Economics and Management		6,0	11
Environmental Engineering		4,0	2
Non-technical subjects	Law, Sociology, Languages, Communication, History of C.E.	6,0	7
Core subjects total		**140**	**136**
Specialisation and Elective Subjects Including Practical Placement and Final Project		**100**	**104**
	Total	**240**	**240**

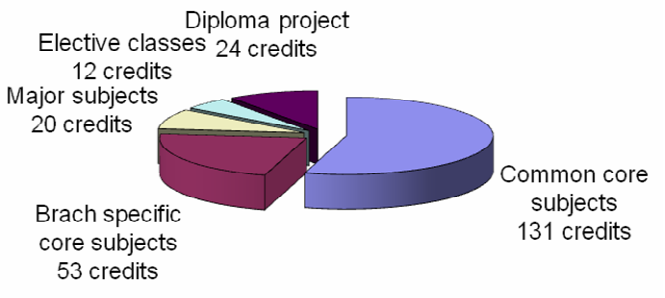
3.1. Grouping of classes in the program

Using the EUCEET breakdown of the Civil Engineering program, classes of subjects are grouped into eight groups.

- Basic science: ~10% (same for all three branches: mathematics, civil engineering representation, physics for civil engineers, chemistry for the building industry).
- Engineering science: ~9% (same for all three branches, statics, strength of materials, dynamics, information science).
- Civil Engineering core subjects: ~27% (same for all three branches: e.g. geodesy, fundamentals of GIS, geology, hydraulics, hydrology, water engineering and water management, building materials, infrastructures, soil mechanics, earthworks, foundations, highways, fundamentals of railway design, wooden-, brick-, stone-, steel-, and reinforced concrete structures, building construction).
- Civil Engineering specialization: ~27% (20 credit block made up of mandatory classes different for each branch and specialized classes).
- Economics, management: ~9% (economics for engineers, building of engineering works, law for building and contracting, contracting, accounting, taxes, etc., city-, region development, safety engineering, and 2-3 branch specific classes per branch.) There is a certain amount (4-6%) of economics integrated in the civil engineering classes as well.
- ~6% Arts, languages, physical education (with no credit value, thus over the 100%) can be taken at will.
- Labs, practices: ~3% (geodesy, and branch specific practices; this includes the four week construction practice without credit value as well).
- Diploma project 10%.



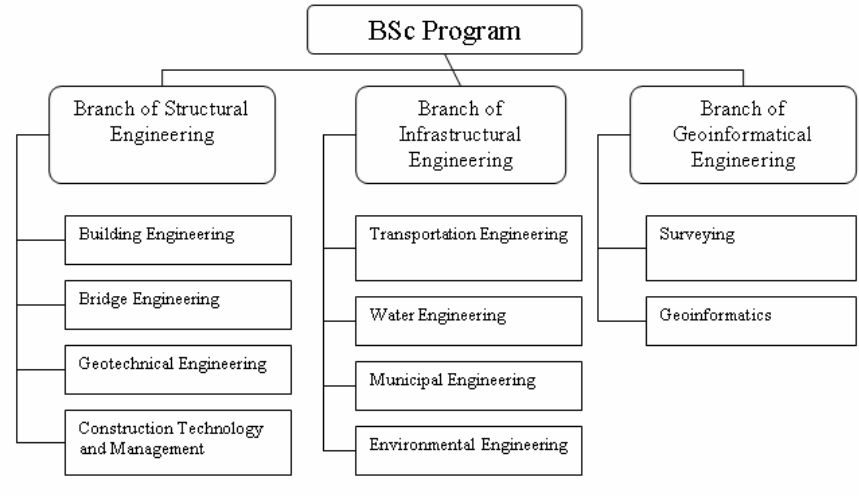
The ratio of the different stages of the above mentioned program is summarized below:



BSc in civil engineering: 240 credits

3.2. Differentiated professional core subjects, branches

The virtually higher weight of the differentiated professional core subjects is summed up by the fact that the previous number of different fields could only be reduced by the introduction of branches and the branch core subjects are 53 credits in each case. This special block is necessary for the students to be able to get their qualifications. At every branch one 20 credit major has to be taken. Fulfilling the major's requirements gives the students competence, which is taken into consideration by the Hungarian Chamber of Engineers when issuing design licenses. The 24 credit diploma project is closely tied to the major.



The frame of the BSc in civil engineering program

3.5. Electives

It is the BME's specialty that students can take 20% extra credits beyond the 240 mandatory ones for free. They can use this contingent to re-take classes that they were not able to pass, or to take second majors.

12 credits of classes can be chosen, that are neither included in the mandatory nor in the mandatory specialized classes. Students take these classes either because are only offered by other branches or to fulfill the requirements of extra majors. They can choose from the classes of the department or from other faculties of the university or even from other universities (e.g. Anatomy, Music).

3.6. System of required previous studies

The sample curriculum gives information about what prior classes are required for a certain class. The mandatory classes were included in the curriculum taking a theoretical 8 semester length of studies and the system of previous studies into consideration.

3.7. Diploma project

The diploma project is a 24 credit class where the student solves a complex design problem based on his or her previous studies with the help of consultants. The diploma project is defended at the final exam. Two experts study and evaluate the diploma project before the final exam. The student applying for the final exam receives the evaluation at least one week before the exam, then prepares for the exam and defends his work based on that.

The defense has two parts:

- In 15-20 minutes, the engineer candidate presents the project, explains the chosen solution (concept) and presents the interesting problems that rose during the design process, then answers the questions given in the written evaluation and the ones given by the graduation examination committee.
- In the second part, the candidate takes the final exam which is based on questions from the subjects of his or her major. The reason out of publishing the questions beforehand is to be able to evaluate the synthesized knowledge of the candidate. The graduation examination committee decides whether the engineer candidate's knowledge is enough to meet the requirements of the profession.

4. THE MSc MASTER PROGRAMS

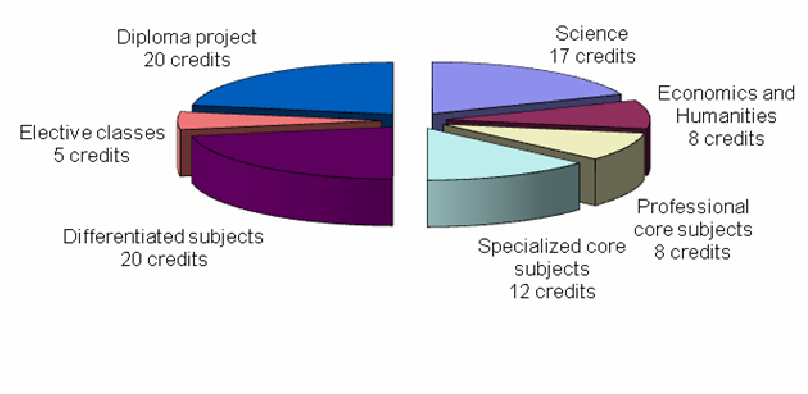
4.1. The goal of the program

The goals of the MSc programs: sending out Civil Engineers with "masters degrees", who, after gaining experience are capable of independently performing the tasks of technical development, research related to Civil Engineering facilities, and have the ability to design and provide consultation for special engineering projects beyond the goals described in the BSc training. The superior senior designer, the consultant and senior consultant titles described by the regulations can be obtained after the required time of practice within the field's branch of graduation. Earning the Master's degree entitles the engineer to enter the PhD program.

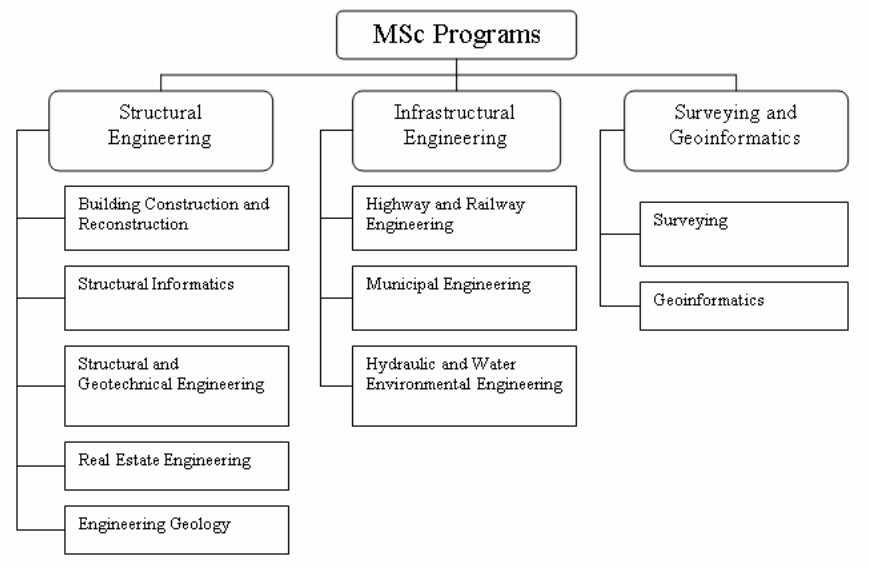
The three main important specific competences of MSc are the following:

- An ability to identify, formulate and solve complex civil engineering problems.
- An ability to design a system or a component to meet desired needs.
- An ability to use the techniques, skills and modern engineering tools, including information technology, necessary for engineering practice.

4.2. Branches and majors



The breakdown of the MSc program



The frame of the MSc in civil engineering programs

5. CONCLUSION

The BME Faculty of Civil Engineering has prepared its program according to the Bologna Process. It features a 240 credit BSc and a 90 credit MSc program. The program was prepared in cooperation with the Chamber and fellow institutes, and was initiated in 2005.

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THE NEW FIRST CYCLE DEGREE PROGRAMMES IN CIVIL ENGINEERING IN EUROPE: PROBLEMS AND SOLUTIONS

W. L. Magette[5]

ABSTRACT

After much debate, the Bologna process for restructuring university education has been accepted in Ireland and is being actively implemented at University College Dublin (UCD). Engineers Ireland, the accrediting body in Ireland for all 3rd level engineering programmes, has also endorsed the Bologna process. Nevertheless, challenges exist for those institutions, such as UCD, that are endeavouring to make the transition from offering 4-year honours degree programmes to offering 2-cycle, "3+2" degrees. This paper outlines some of those challenges and how UCD is attempting to address them in its civil engineering programme of studies.

1. INTRODUCTION

With one exception, engineering programmes at UCD are 4 years in duration, and lead to an honours degree (Bachelor of Engineering). These programmes are accredited nationally by Engineers Ireland, and are recognised internationally by a number of countries via the Washington Accord, to which Ireland is signatory. The civil engineering programme at UCD achieved full accreditation in May 2006, for a period of 5 years.

In September 2005, University College Dublin (UCD) began to translate its 1st-year course offerings into modular units using the European Credit Transfer System as a basis for the quantity of content (and contact hours, student workload, etc.). Prior to 2005, programmes consisted of many courses with durations of an entire academic year. In 2006, both 2nd and 3rd-year courses were changed to a modular format. In 2007, the modularisation process will be completed with the translation of 4th year courses.

In 2006, discussions also began in earnest among engineering disciplines for the development of 5-year programmes consisting of a 3-year "bachelor's" degree and a 2-year "master's" degree. These discussions are ongoing with the

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intent of offering a 3-year Bachelor of Science (Engineering Science) degree in 2008.

2. MAIN FEATURES

Still in "draft" form, the current BSc programme in Engineering Science is proposed to foster progressive specialisation among students that pursue it, with the ultimate goal of enabling students to enter one (or more) specialised, 2-year Master of Engineering programmes, including a "mixed" engineering programme (Engineering with Business) and a non-engineering programme (Medicine). In the first stage of study (i.e. year 1, 60 ECTS), all students will take identical modules, except for 2 electives (Table 1). In stages 2 and 3, the commonality among modules that students will take decreases, while the number of discipline specific modules increases.

Table 1. Core, Recommended and Optional Modules (nominally 5 ECTS each) in BSc (Engineering Sciences) for Civil Engineering "Stream"

Stage 1		**Stage 2**		**Stage 3**	
Sem 1	**Sem 2**	**Sem 1**	**Sem 2**	**Sem 1**	**Sem 2**
Maths for Eng. I diff. calculus*	Maths for Eng. III integ cal & diff eqn*	Maths for Eng. IV multivar calculus*	Maths for Eng. V probability & statistics*	Maths for Eng. VI diff. eqns*	Numerical Methods for Engineers*
Maths for Eng. II linear algebra*	Mechanics for Engineers*	Applied Dynamics I*	Mechanics of Solids I**	Measurement and Instrumentation*	Analysis of Structures***
Physics for Engineers I*	Physics for Engineers II*	Mechanics of Fluids I**	Materials Science & Engineering I**	Econom, Accounting & Finance	Design of Structures***
Chemistry for Engineers*	Computer Science for Engineers**	Engineering Graphics**	Surveying***	Soil Mechanics***	Hydraulics***
Eng. Thermo. and Fluid Mech.*	Elective	Building Construction***	Elective	Elective	Mechanics Solids II***
Elec. & Electronic Engineering I*	Elective	Elective	Elective	Professional Eng.**	Design & Project**
Optional Modules (Technical Electives)					
	Theory & Design of Structures I	Building Construction	Theory & Design of Structures II	Theory & Design of Structures III	Design of Structures
		Construction Materials	Surveying	Analysis of Structures	
				Continuum Mechanics	Soil Mechanics
		Environmental Engineering Fund.	Computer Apps. in Civil Eng.	Hydraulics	

* = Core module required of all engineering students

** = Core module required of all civil engineering students
*** = Recommended optional module for civil engineering students

Relative Weightings of Subject Matter

The BSc (Engineering Science) degree must include 100 ECTS credits from Stage 2 modules and above, including at least 40 ECTS from Stage 3 modules. Making up the core of the BSc (Engineering Sciences) curriculum (i.e., modules taken by all students regardless of specialisation) are 35 ECTS in mathematics; 15 ECTS in basic sciences; and 25 ECTS in engineering sciences (Table 1). The remaining ECTS credit requirements are comprised of a variety of "traditional" civil engineering subjects, some of which are required and some of which are recommended, together with free electives.

Character of the First Cycle Degree

The 1st cycle Bachelor of Science in Engineering Science degree at UCD is very much a "pivot point" degree that prepares students to pursue professional engineering degrees in the 2nd cycle (or, indeed, to leave engineering studies to pursue other interests). It is not designed as a terminal degree prior to employment.

Anticipated Employability

While it is conceivable that students could find employment after completing the first cycle degree (e.g., as an engineer's assistant or other technician), the Bachelor of Science degree in Engineering Science is not intended to be a terminal degree leading to a career as an engineer. Indeed, for students to achieve chartered status as a professional engineer in Ireland, they will be required (by Engineers Ireland, the accrediting body for engineering programmes and licensing body for engineers) to successfully complete a 2nd cycle Master of Engineering degree.

Percentages of Students Likely to Pursue the 2nd Cycle Degree

For the reasons outlined under "Anticipated Employability", it is anticipated that virtually 100% of students in the Bachelor of Science (Engineering Science) degree programme will pursue the 2nd cycle degree in an engineering discipline. Without doubt, there will be a minority of students that do not perform well enough academically to acquire the 1st cycle degree; however, this number is anticipated to be small due to the rigorous entry requirements for students that wish to start the degree programme. Likewise, there may be a few students that decide to abandon engineering studies in favour of other interests.

In the main, however, the BSc in Engineering Science is being designed as a preparatory degree for the 2nd cycle degree programmes in engineering.

Industry / Professional Reactions

Industry and professional reactions to the Bologna process were expressed through a consultation process conducted by Engineers Ireland prior to its formally endorsing the concept of a revised structure for university education in engineering. The fundamental concern would have been regarding the resulting quality and content of new "3+2" degrees relative to the existing 4-year degrees, which are internationally recognised for their quality.

More specific views regarding the direction of the civil engineering degree programme at UCD were expressed by industry representatives on the accreditation panel that examined the programme in May 2006. The fundamental concern, however, was about the content and quality of the new "3+2" degree programme.

Challenges and Solutions

At the time of this report (March 2007), academic staff in civil engineering at UCD have completed their revision of 1st, 2nd and 3rd year courses to comply with the modular format adopted by UCD. In the main, modules have a value of 5 ECTS and an associated time commitment (by students) of 125 hours. Staff members are actively revising 4th year courses to serve existing students, as well as those who will enter the programme prior to the introduction of the Bachelor of Science (Engineering Science) degree in 2008. Simultaneously, efforts are underway to visualise the nature of the 2nd cycle degree in Civil and Environmental Engineering. All deliberations are being conducted with the fundamental objective of producing degree programmes that will receive full accreditation by Engineers Ireland.

A fundamental challenge of the modularisation process has been how to "split" (or in some cases, condense) comprehensive courses into one or more modules. Due to a variety of factors, not the least of which is the university calendar, staff members have found it difficult to find time to cover one year of content in 2, 12-week, 5 ECTS modules – given the constraints on student time requirements per ECTS. So far, this obstacle has been addressed by frank discussions among staff members to critically evaluate necessary content and avoid duplication of content among modules.

Another practical obstacle has been the need to develop defensible assessment criteria (and find time) for the work experience requirement in the curriculum. Currently, in the 4-year programme, students typically spend the summer following their 3rd year of study gaining profession work experience. Heretofore, student "performance" has been assessed through short interviews of employers and written reports by students of their experience. The

constraints imposed by ECTS credits and the assessment mandated by UCD has forced a re-evaluation of when the work experience will take place in future and by what criteria marks will be awarded. It is likely that students in the new "3+2" programme will need to wait until the first year of the 2nd cycle degree before pursuing this valuable work experience. A formal check-sheet will be sent to employers to serve as an evaluation tool by which to assess each student.

Whenever there is a change from one degree structure to another, issues of transition arise. At UCD, this means that some students will be pursuing a 4-year programme of studies while other students are pursuing a "3+2" programme. Because of constraints on resources (number of faculty members) and time (scheduling) the challenge is to serve both cohorts of students simultaneously through courses that are as similar as possible in their requirements. While this is a recognised challenge, no solutions have been developed to minimise its impact.

3. SUMMARY

The transition from a widely recognised 4-year degree structure in civil engineering to a Bologna-style "3+2" degree structure is posing challenges at University College Dublin. A fundamental premise underlying the transformation to the new degree structure is that the quality of engineering education imparted to students will not be compromised. In practical terms, this means that at the end of the transformation, UCD Civil Engineering is determined that its degree programmes will still be fully accredited by Engineers Ireland. (This recognition should also make it possible to achieve accreditation on a pan-European basis via EURACE and globally via the Washington Accord.) Given such a high standard for quality, the transition is made all the more difficult by fixed resources (time, money and academic staff) as well as by a certain level of uncertainty regarding the 2nd cycle degree. These challenges are being addressed, with a target of offering a Bachelor of Science in Engineering Sciences in academic year 2008-2009.

Acknowledgement

The input of Drs. David Timoney (Mechanical Engineering, UCD) and Patrick Purcell (Civil Engineering, UCD) is gratefully acknowledged.

THE NEW FIRST CYCLE DEGREE PROGRAMMES IN CIVIL ENGINEERING IN ITALY: THREE EXAMPLES

Diego Lo Presti[6]

1. INTRODUCTION

The present report illustrates the application of Bologna Declaration (19.VI.1999) in Italy trough the reform (Decreto 509/1999). Because of the University autonomy, the above mentioned reform has been applied in different ways. Based on the author personal experience, the paper shows the most relevant aspects of the reform implementation in three different University Campuses, as far as the Civil Engineering Courses are concerned. More specifically: the 1st Faculty of Engineering of the Politecnico di Torino (located in Torino), the 2nd Faculty of Engineering of the Politecnico di Torino (located in Vercelli) and the Faculty of Engineering of the University of Pisa. In short the three campuses will be called Torino, Vercelli and Pisa in the next of the paper.

The reported information is updated to the year 2007. Since that year, the Italian Universities experienced several changes.

2. CURRICULA

Table 1 to 3 summarizes for the three campuses the number of credits allocated for basic subjects, civil engineering subjects and other engineering subjects. Such information is given for each of three years.

Differences between the three campuses are evident. Torino and Pisa still have a certain percentage of basic subjects in the second year, while at Vercelli the engineering subjects become predominant since the second year.

It is worthwhile to consider the subjects given in the three different campuses. Such information is summarized in Tables 4 to 6. From this information, it is quite evident that curricula in Vercelli are more oriented to the education of professional engineers, while in the other two campuses the scientific formation is prevailing. As an extreme consequence, students who graduate in Pisa do not attend any class of structural design, which is quite illogical and forces students to continue with the next second study cycle.

In conclusion, students who graduate in Vercelli have enough professional competencies to begin a professional activity and solve simple and repetitive

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practical problems. On the other hand, students who graduate in Pisa do not have almost any professional competency and consequently are forced to continue their studies.

Table 1 Curricula at Torino Campus

Year	Basic Subjects	Civil Eng. Subjects	Other Eng. Subjects
1st	35	5	5
2nd	22.5	23	14.5
3rd	-	45	5

Table 2 Curricula at Vercelli Campus

Year	Basic Subjects	Civil Eng. Subjects	Other Eng. Subjects
1st	34	8	9
2nd	13	35	19
3rd	-	42	

Table 3 Curricula at Pisa Campus

Year	Basic Subjects	Civil Eng. Subjects	Other Eng. Subjects
1st	36	6	6
2nd	24	12	15
3rd	-	42	6

Table 4 Subjects: Torino Campus

Year	Basic Subjects	Civil Eng. Subjects	Other Eng. Subjects	Other
1st	Mathematics, Linear Algebra and Geometry, Physics, Chemistry	Drawing	Computer Science	Geology, English
2nd	Mathematics, Physics, Theoretical Mechanics	Topography, Structural Mechanics, Building Technology and Details	Technical Physics, Applied Chemistry	Economics and law
3rd	-	Roads, Geotechnics, Hydraulics, Structural Design, Building yards and plants	Electrical Engineering	Thesis, student choice (10 credit)

Students who graduate in Torino are in an intermediate condition between their colleagues in Vercelli and Pisa. Obviously they have enough professional competencies to start a professional activity and solve simple and repetitive problems. It is surprising to observe the very different ways of implementation of the same reform in various Italian Universities.

Table 5 Subjects: Vercelli Campus

Year	Basic Subjects	Civil Eng. Subjects	Other Eng. Subjects	Other
1st	Mathematics, Linear Algebra Statistics, Chemistry, Mechanics, Electromagnetism, Optics	Drawing, CAD	Computer Science	Multidisciplinary project
2nd	Advanced mathematics	Topography, Structural Mechanics, Building production, Hydraulics, Hydrology, History of Architecture	Technical Physics, Applied Chemistry, Applied thermodynamics	Multidisciplinary project
3rd	--	Roads, Geotechnics, Hydraulic infrastructures,, Structural Design, Building technology and details, Transportations, Construction cost evaluation	Computer Science	Thesis, English, Multidisciplinary project

Table 6 Subjects: Pisa Campus

Year	Basic Subjects	Civil Eng. Subjects	Other Eng. Subjects	Other
1st	Mathematics, Linear Algebra and Geometry, Physics, Chemistry	Drawing, Topography	CAD, Applied Chemistry	English
2nd	Mathematics, Theoretical Mechanics, Geometry	Building Technology and Details	Electrical Engineering	Economics and law, student choices (9 credits)
3rd	-	Roads, Geotechnics, Structural Mechanics, Hydraulics	Technical Physics	Thesis, practical placement

3. STUDENT CAREER

The main features concerning student career are summarized in Tables 7 to 10. More specifically, Tables 7 to 9 show, for each campus, the total number of enrolled students (first & second cycle) and the number of enrolled students at first year (first and second cycle). The above statistics concern the years from 2002 to 2006.

It is possible to observe:

- a general increase of students in Civil Engineering courses;

- the relatively small number of graduated students in comparison to those that have been enrolled;
- the number of students enrolled at the first year of the second cycle is almost equal to the number of graduated students from first cycle.

Table 7 Student career – Torino (No of graduated in bracket)

Year	Total Students (1st Cycle)	1st year (1st Cycle)	Total Students (2nd Cycle)	1st year (2nd Cycle)
2002 - 2003	617 (17)	147		
2003 – 2004	735 (63)	163	54	45
2004 – 2005	1013 (106)	284	143	88
2005 - 2006			243	137

Table 8 Student career – Vercelli (No of graduated in bracket)

Year	Total Students (1st Cycle)	1st year (1st Cycle)	Total Students (2nd Cycle)	1st year (2nd Cycle)
2002 - 2003	184 (11)	33	11	11
2003 – 2004	207 (15)	46	21	12
2004 – 2005	245 (26)	56	34	13
2005 - 2006	260	50	45	26

Table 9 Student career – Pisa (No of graduated in bracket)

Year	Total Students (1st Cycle)	1st year (1st Cycle)	Total Students (2nd Cycle)	1st year (2nd Cycle)
2003 - 2004	539 (22)	145	8	
2004 – 2005	648 (35)	107	32	9
2005 – 2006	706 (70)	125	84	15
2006 - 2007	681 (15)	107	125	37

It is also quite instructive to analyse the student career in the Torino Campus. These statistics refer to the year 2004 – 2005. Of the 1013 students in Civil Engineering in Torino, for the year 2004 – 2005, 87 initiated their career in between 1996 – 1998. The number of students (enrolled in Torino in 2004 – 2005) divided by the year of initiation of their career is reported in Table 10. The sum of student number reported in Table 10 plus the 87 above mentioned is less than 1013, because some students initiated before 1996.

Table 10 Analysis of students (first cycle) Torino – year 2004 - 2005

Year (initiating career)	No of students
2004 – 2005	284
2003 – 2004	154
2002 – 2003	149
2001 – 2002	124
2000 – 2001	114
1999 – 2000	77

The above reported tables clearly show the slowness of the student career and the quite high number of students that give up.
More complete statistics (see reference list) indicate that "on average" students graduate in Civil Engineering (first cycle) in 4.5 years. Moreover, from 10 to 100% continue their study entering the second cycle. Therefore, first cycle is mainly seen as a break point.

4. REACTIONS OF INDUSTRY/PROFESSIONAL WORLD

Reactions from industry/professional world can be summarised as follows:
- Industry requires a very high level of qualification but would pay a very small salary;
- Professional association, for self – defence reasons (better not too many engineers) is completely against the reform. Anyway, they obviously accepted the Ministry reform of the Civil Engineering Association (Ordine degli Ingegneri) accepting the affiliation as certified engineers (junior section) of first cycle graduated;
- Public Administrations are just starting to have public competions reserved to first cycle graduated

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THE FIRST CYCLE DEGREE IN CIVIL ENGINEERING IN RZESZOW UNIVERSITY OF TECHNOLOGY

Szczepan Wolinski[7]

1. INTRODUCTION

Rzeszow University of Technology's history dates from 1951, when Engineering School was opened in Rzeszow, the capital of Podkarpacie Region in the south-eastern part of Poland. In 1974, by a government decree, the school was christened the I. Lukasiewicz Rzeszow University of Technology. Presently the University is the largest polytechnic school in the region and continues to grow. Over its history it has educated 32,500 graduates, including 430 civil pilots. In the current term the University has an enrolment of 12,500 students at 6 faculties and 16 courses of study.

The Faculty of Civil and Environmental Engineering came into existence in 1966. The students of the Faculty can choose between two courses: Civil Engineering and Environmental Engineering and between several specialities, all the intramural and extramural. The Faculty educates about 1500 full-time (800 in civil engineering) and 600 part-time students yearly (350 in civil engineering). The academic staff numbers 120 persons, including 8 full and 16 associate professors and 57 academic teachers with PhD degree. There are 14 departments and 21 laboratories to develop didactic, research and technical activities at the Faculty. The Faculty is entitled to award PhD degree in civil engineering.

According to the new Polish Law for Higher Education (2005), from the academic year 2007/2008 two-tier study programmes in civil engineering education is obligatory, following the Bologna Declaration. Two-tier programmes are now introduced into operation at the Faculty of Civil and Environmental Engineering in Rzeszow UT.

2. INFORMATION ON THE CURRENT DEGREE PROGRAMMES

2.1 Master and doctoral programmes

Until the academic year 2006/2007, the intramural students studied for five years to obtain MSc degree in civil engineering. Six optional specializations are

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provided in the Building & Civil Engineering Structures specialty: building and engineering structures, bridge building and maintenance, urban building engineering, computer aided design, theory of structures and marketing in building engineering.

The syllabus of integrated MSc course in civil engineering (5 year = 10 semesters) includes three groups of subjects: A – generic, common to the course, B – basic, fundamental to the course and speciality, and C – specialist, relating to the specializations. Study programmes fulfill the criteria recommended by The State Accreditation Committee and by the FEANI. The student's work consists of: contact hours, individual studying, homework (project and design works) and training before tests and exams. The number of contact hours per the whole study period is 3600.

Necessary conditions to obtain the MSc degree are as follows: to complete the subjects included in programme (300 ECTS credits), to complete field works (4 weeks) and industrial trainings (at least 12 weeks), to prepare and defend MSc thesis.

Individual programmes for the PhD degree in civil engineering involve an individual research programme which must be finalized with a PhD Thesis (an original contribution to the science), three doctoral exams and a public defence of the PhD Thesis.

2.2 Two-tier extramural programmes

The current programs for the extramural studies consist of two stages: the undergraduate level awarded with the BSc degree (called *inżynier*), and the graduate level awarded with the MSc degree (called *magister inżynier*).

The nominal duration of the undergraduate study is 4.5 years (9 semesters). The total number of contact hours per the whole study period is 1615. The syllabus of the BSc course includes three groups of subjects: A – generic, B – basic, C – specialist, the humanities and foreign languages. Necessary conditions to obtain the BSc degree are as follows: to complete the subjects included in programme, to complete field works (2 weeks) and industrial trainings (at least 6 weeks), to pas the final exam, to prepare and defence the BSc thesis (or engineering project).

The nominal duration of the graduate studies is 1.5 years (3 semesters). The sum of contact hours per the whole study period is 350. There are three groups of subjects: A – generic, B – basic, C – specialist, and the humanities. Necessary conditions to obtain the MSc degree are as follows: to complete the subjects included in programme to complete and to prepare and defend MSc thesis. In the Faculty there is one speciality: Building & Civil Engineering Structures at both levels of extramural education.

3. FIRST CYCLE OF NEW TWO-TIER DEGREE PROGRAMME

3.1 Main features of the undergraduate programme

Two-tiers programmes are now introduced into operation at the Faculty and will start from the academic year 2007/2008 for the intramural as well as for the extramural studies.

For the intramural studies, the total number of contact hours the course providing the basic engineering education with 3.5 years duration (7 semesters, each semester 15 weeks), is awarded with the BSc degree in civil engineering (called *inżynier budownictwa*), and provides the basis for the second tier studies. There is one general speciality Building & Civil Engineering Structures at this level of education.

Admission to civil engineering course at the BSc level is based on points achieved in the state examination at the end of secondary education (called *matur*a). Every applying student who has points more or equal to the threshold declared by the Faculty is accepted.

The syllabus of the BSc course in civil engineering includes three groups of subjects: A – generic, B – basic, C – specialist, and supplementary subjects: the humanities, foreign languages and physical education. The student's work consists of: contact hours, individual studying, homework (projects and design works) and training before tests and exams. There are the following types of contact hours: lectures, theoretical classes, laboratories, projects, field works, and additionally industrial trainings.

The group of generic subjects includes 6 items: mathematics, physics, chemistry, geology, mechanics and computer science. A sum of 450 contact hours and 42 ECTS credits are assigned to this group of subjects.

The group of basic subjects includes 18 items: drawings and descriptive geometry, geodesy, building materials, strength of materials, structural mechanics, buildings, soil mechanics, foundations, concrete structures, steel structures, building services and installations, transport engineering, building physics, hydraulics and hydrology, organization of building site, building construction technology, management of construction processes, and economics of construction industry. A total of 1340 contact hours and 115 ECTS credits are assigned to this group of subjects.

The third group of specialist subjects includes 10 items: computer aided design, concrete technology, industrial structures, timber structures, building repairs and modernization, history of architecture, building law, energy saving buildings, urban planning and architecture, and diploma project. A sum of 505 contact hours and 44 ECTS credits are assigned to this group of subjects.

The last group of 3 supplementary subjects include: the humanities, foreign languages and physical education, with 210 contact hours and 9 ECTS credits assigned.

The total number of contact hours per the whole study period is 2505 (about 24 hours per week), and 210 ECTS credits (7 semesters × 30 ECTS credits) has been assigned to the first cycle degree programme.

Teaching material is divided for 34 subjects (+ 3 supplementary subjects). Summing up these numbers of contact hours (and ECTS credits) over the 3.5 years give the following split categories: generic subjects 18% (20%), basic subjects 53.5% (54.8%), specialist subjects 20.1% (21%), and supplementary subjects 8.4% (4.2%).

From among the total number of contact hours there are: 900 (35.9%) lectures, 645 (25.7%) theoretical classes, 600 (24%) project (practical designing), and 360 (14.4%) laboratory. Number of exams is 18 (+ the final exam).

Necessary conditions to obtain the BSc degree are as follows: to complete the subjects included in programme (210 ECTS credits), to complete field works (2+2 = 4 weeks) and industrial trainings (at least 8 weeks), to pass the final exam, to prepare and defence the BSc thesis (or engineering project).

3.2 The character of the first cycle degree

The graduates of the Faculty (Bachelors of Civil Engineering) are taught the basis of engineering disciplines. They are also trained in skills, which make effective application of their knowledge possible, and formed in attitudes that assure responsible and honest performance and approach to their work in professional life. The personal, interpersonal and most general human skills and attitudes are important factors in the education of the graduates.

The graduates in civil engineering have knowledge of the following issues: building components and materials, construction processes, designing of simple structures, construction planning and organization of building site, management in building industry, and civil engineering information systems. They are able to: manage building site, assist in design of construction works, organize and manage the production of building elements, supervise construction processes, and to continue the long-life education. Moreover, they have abilities necessary to match objectives with appropriate technological solutions, to identify main aspects of design, and to make use of modern computer aided techniques.

The graduates can perform tasks in construction companies as building site engineers, in maintenance and use of buildings and construction works as well as in the industry of building materials, semi-finished parts or prefabricated elements, and can apply for the second cycle degree programme in civil engineering.

4. CONCLUDING REMARKS

The impact of the Bologna process on civil engineering education in Poland as well as in the Faculty is significant, especially in the lights of the new Polish Law for Higher Education (2005) and the amendment to the Polish Building Law (2005). The first introduces obligatorily the two-tier study programmes in all technical disciplines. The second encourages graduates of the first cycle study in civil engineering to make an attempt to continue the second cycle degree, as it is the basic and necessary condition to obtain the professional licence indispensable to fulfil duties reserved for the chartered civil engineers.

However the MSc courses are dominating in Polish educational system, more than 25% of professionally active civil engineers (members of the Polish Chamber of Civil Engineers) are graduates of the BSc studies. For the majority of employers the professional experience and acquirement of the professional licence are the most important factors deciding about employment and payment of civil engineers. As most present graduates with the BSc degree finish the extramural studies, their chance for the first job in building industry is somewhat worse than for the graduates with the MSc degree.

The reaction of the professional world for the changes occurring is ambiguous. Generally, the opinion that organization of study programmes is less important than their content and quality of education process is predominant. Moreover, these changes are often perceived as unimportant and irrelevant to the civil engineering profession.

THE NEW FIRST CYCLE DEGREE PROGRAMME IN CIVIL ENGINEERING AT THE UNIVERSITY OF BEIRA INTERIOR – A PORTUGUESE CASE STUDY

João Leal[8], Ryszard Kowalczyk[9]

1. INTRODUCTION

The civil engineering course at University of Beira Interior (UBI) begun in 1988, since then the course programme has been regularly evaluated by the Portuguese Association of Civil Engineers (PACE) and by the Foundation of Portuguese Universities. At this time the course is recognized by the PACE allowing the new graduated students to exercise the profession of civil engineer after a six month stage in a building site or construction company or design office. It should be mentioned that in Portugal only six civil engineering courses are recognized by the PACE. This association is responsible in Portugal for issuing the professional degree of engineers to the graduates from University. This means that in Portugal a person can only work as an engineer after getting the permission from the PACE.

In Portugal the discussion about the Bologna process was started in 2005, but without any idea about the type of rules that would be imposed by the government. At the beginning of 2006 the universities deans received the general principles from the government, and finally the education system had the conditions to start the discussion about the new course programmes. Generally those principles stated that polytechnic schools should have 1st cycle formations more oriented to professional and technical knowledge and that universities should have 1st and 2nd cycles with a strong scientific formation. The government has imposed also that the civil engineering courses should have two stages (cycles): 3 + 2 years or integrated course of 5 years in selected universities leading to Master degree. The consequence of this division was assignment of 180 ECTS to the 1st cycle and 120 ECTS to the 2nd cycle. It is planned that in the future the government will finance only the 1st cycles and only some selected 2nd cycles of integrated 5 years courses. The 2nd cycle of 2 stages courses are to be financed by fee collected from the students. At the same time the PACE made clear that they will recognise as civil engineers only graduates of universities with at least 5 years formation.

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In this context the Department of Civil Engineering and Architecture (DECA) of UBI was forced to adopt a two cycle programme (3 + 2).

2. MAIN FEATURES OF THE OLD AND NEW PROGRAMME

The old programme (see Table 1) was prepared for 5 years cycle. In the first two years the programme was composed mainly of basic scientific subjects (mathematics, physics, chemistry, drawing, geology and informatics). The 3rd year was dedicated to basic civil engineering core subjects (hydraulics, resistance of materials, soil mechanics and construction materials). The 4th year was composed of disciplines aiming to the application of scientific subjects to real civil engineering works (hydrology, water supply and drainage systems, structures, concrete structures, roads, construction technology, buildings, urban and regional planning). The last year was divided into 3 specializations (structures and construction, urban planning and geotechnics), and the programme was offering subjects dedicated to more specific areas of civil engineering (pre-stressed concrete, seismic engineering, special structures, pathology and conservation of buildings, traffic engineering, urban management, geohydraulics, foundations, environmental geotechnics, etc.). In this last year some general subjects also appeared (economics, construction management and introduction to social sciences) and all specializations ended with a final project.

The new programme for the 1st cycle (see Table 1) was established based on the following premises:

- The formation obtained by the students in the secondary schools in the areas of mathematics, physics, informatics, chemistry and drawing must be improved, and therefore these subjects, although reduced, must be included in the 1st cycle.
- The basic civil engineering core subjects must be present in the 1st cycle allowing the application of mathematical, physical and chemistry concepts to basic subjects related to civil engineering.
- Even after reducing some of the basic scientific and basic civil engineering subjects mentioned above, the 3 years of 1st cycle (180 ECTS) gives not enough space for including all the professional subjects required to prepare a civil engineer able to find a job. Taking into account above assumptions the 1st cycle degree will not give sufficient abilities for a full professional diploma and therefore could be only recognised as a “mobility” diploma with limited professional skills.

Table 1 – ECTS for each scientific area in the first 3 years of the old and the new programmes

Scientific Areas	Subject	Subject level	OLD PROGRAMME (ECTS)	NEW PROGRAMME (ECTS)
BASIC	Mathematics and Applied Mathematics	basic	42	36
	Applied Chemistry	basic	6	6
	Applied Physics	basic	18	6
	Computer Science and Comp. Methods in C.E.	basic	12	9
	Engineering Geology	basic	6	6
	Drawing and Descriptive Geometry	basic	12	6
	Economics and Management	basic	0	6
STRUCTURES	Mechanics	basic core	12	12
	Mechanics of Materials	basic core	12	12
	Structural Mechanics	application core	0	6
CONSTRUCTION	Building Materials	basic core	12	12
	Structural Concrete	application core	0	6
	Construction Technology & Organisation	application core	6	12
HYDRAULICS	Fluid Mechanics & Hydraulics	basic core	12	12
	Water Structures and Water Management	application core	0	6
GEOTECHNICS	Soil Mechanics and Geotechnical Engineering	basic core	12	6
URBAN PLANNING	Optimization Systems	basic core	6	0
	Transportation Engineering	application core	0	6
	Urban & Regional Planning	application core	0	6
SURVEY	Engineering Surveying	basic core	6	6
OTHERS	Introduction to Civil Engineering	non-technical	6	3
TOTAL			180	180

In order to establish space for more professional subjects in the new 1st cycle the reduction of 42 ECTS in the old programme was necessary. These was achieved by following changes in the content of some subjects foreseen for the first cycle: mathematics was reduced by 6 ECTS (Fourier analysis and complex numbers), physics was reduce by 12 ECTS (thermodynamics and electromagnetism), informatics was reduced by 3 ECTS (in the old programme the teaching of CAD was overestimated), drawing was reduced by 6 ECTS (this subject was overestimated in the old programme), soils mechanics was reduced by 6 ECTS (the subjects of compressibility and consolidation of soils and rupture theories were transferred to the 2nd cycle), optimization systems was reduced by 6 ECTS (this subject was considered secondary when compared with the others), and introduction to civil engineering was reduced by 3 ECTS (this subject was overestimated in the old programme).

These 42 ECTS were distributed in the new 1st cycle as follows: 6 ECTS in economics (that could not stay in the 2nd cycle), 6 ECTS in structures (structural mechanics), 12 ECTS in construction (structural concrete and construction management), 6 ECTS in hydraulics (water supply and drainage systems) and 12 ECTS in urban planning (transportation engineering and urban and regional planning).

The relative weight of each scientific area in the first 3 years of the old and the new programmes is presented in Fig. 1. Generally, one can conclude that mathematics; physics; and drawing subjects are reduced and substituted by subject related to civil engineering.

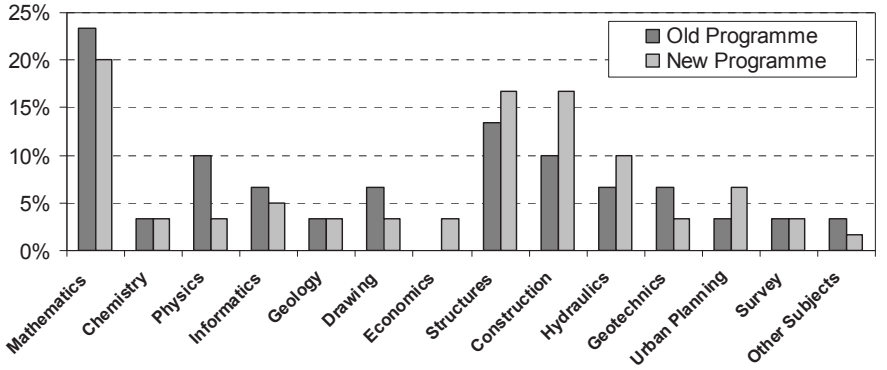

Figure 1 – Relative weight of each scientific area in the first 3 years of the old and the new programmes

The level of the subjects in the first 3 years of the old and the new programmes is presented in Fig. 2. Generally, one can conclude that basic and basic core subjects are reduced and being substituted by application core subjects. This was done in order to provide some professional skills at the end of 1st cycle. Nevertheless, application of several important core subjects (around 42 ECTS) was impossible to include in a 180 ECTS of 1st cycle, and therefore they had to be included in the first two semesters of the 2nd cycle.

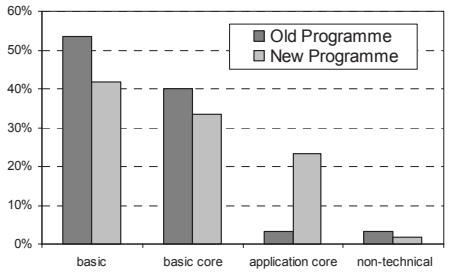

Figure 2 – Relative weight of each level of the subjects in the first 3 years of the old and the new programmes

3. CONCLUDING REMARKS

The new 1st cycle was created taking into account that it should have 180 ECTS and that at the end the student should have some professional skills. It was also taken into consideration the formation level of the students at the entrance, i.e., after completing the secondary school. The first step was to review all the programmes of basic and basic core subjects reducing them to what is essential for a civil engineering formation, keeping in mind that the scientific formation should be assured. Afterwards, the application of core subjects, which are not directly linked to scientific research, were passed to the 1st cycle, leaving for the 2nd cycle all application and specialization core subjects that can lead to scientific works (MSc thesis) and design. During this process, it was concluded that 180 ECTS are insufficient to give the necessary skills required for a civil engineer profession. On the other hand a 1st cycle with 240 ECTS should be more adequate for that purpose. Unfortunately we did not have that possibility. Therefore, the 1st cycle will lead to a diploma which is mostly a break point with limited professional skills. It is expected that the majority of the students will continue straight to the 2nd cycle degree. It is also expected that some of the students ending the 1st cycle in polytechnics can enter the 2nd cycle at universities.

In Portugal, at this time the industry and professional world are still not aware of what is happening. It is expected that few students completing the 1st cycle will be absorbed by the professional world, because to design and signing a project it is necessary to be a member of the PACE and for that it is required at least a 5 year formation (300 ECTS).

1ST CYCLE OF EDUCATION IN CIVIL ENGINEERING

Irina Lungu[10]

At the Technical University "Gh. Asachi" Iasi, the 1st cycle of education in Civil Engineering as a result of the Bologna process began in October 2005 with 3 profiles for a duration of 4 years:

- Civil Engineering (in Romanian) – with the specialization in:
  - Civil, Industrial and Agricultural Buildings
  - Railways, Roads and Bridges
  - Urban Development
- Civil Engineering (in English)
- Building Equipments (in Romanian)

The structure of the curricula for the above mentioned specializations is presented according to the percentage of the group of subjects/disciplines.

Civil, Industrial and Agricultural Buildings – in Romanian and English

Group of subjects	Number of hours	% out of the total hours	Number of ECTS	% out of the total ECTS
General technical education	550	17,45	44	18,33
General engineering education	1622	51,45	116	48,33
Specialized subjects	812	25,76	66	27,50
Complementary subjects	168	5,34	14	5,83
Total hours/ECTS	3152	100	240	100

Railways, Roads and Bridges – in Romanian

Group of subjects	Number of hours	% out of the total hours	Number of ECTS	% out of the total ECTS
General technical education	550	17,45	43	17,92
General engineering education	1384	43,90	99	41,25
Specialized subjects	1050	33,31	84	35,00
Complementary subjects	168	5,34	14	5,83
Total hours/ECTS	3152	100	240	100

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Urban Development – in Romanian

Group of subjects	Number of hours	% out of the total hours	Number of ECTS	% out of the total ECTS
General technical education	550	17,45	40	16,67
General engineering education	1524	48,35	115	47,92
Specialized subjects	910	28,87	71	29,58
Complementary subjects	168	5,33	14	5,83
Total hours/ECTS	3152	100	240	100

Building Equipments – in Romanian

Group of subjects	Number of hours	% out of the total hours	Number of ECTS	% out of the total ECTS
General technical education	550	17,45	43	17,92
General engineering education	1328	42,13	87	36,25
Specialized subjects	1106	35,09	94	39,17
Complementary subjects	168	5,33	16	6,67
Total hours/ECTS	3152	100	240	100

There are students that, beginning with the 3rd year of education, decide for a part-time or full-time employment; our faculty board designed a specialization based on evening courses, with the same number of ECTS (240) and a duration of 5 years.

The 1st cycle is graduated based on a license examination to obtain the bachelor degree that represents a certification to access the labour market and a break-point to enroll into the 2nd cycle.

Together with the above mentioned curricula, the graduation of 1st cycle is going to certify that the professional development at this stage is acquired by the following:

a) general competences

- Basic knowledge of the profession,
- Capacity for applying knowledge in practice,
- Capacity to adapt to new situations,
- Decision-making,
- Interpersonal skills;

b) specific competences

- An ability to identify, formulate and solve common civil engineering problems,
- An understanding of the elements of project and construction management of common civil engineering works,

- A recognition of the need for, and the ability to engage in life-long learning,
- An ability to use techniques, skills and modern engineering tools, including IT, necessary for engineering practice,
- An understanding of professional and ethical responsibility of civil engineers.

At present, employers are skeptical about the general expertise of the graduates resulted from the Bologna process since they were used to discuss with a 5-year graduate. On the other hand, Romania, as a country recently joining European Union, experiences an accelerated development in terms of constructions generally, buildings, urban and transportation infrastructures and thus the labour market, especially the field work is demanding more civil engineers each year. In this respect, the short term impact of the new graduates from the Bologna process (as a shortened education) is expected to be less obvious at first.

The companies involved in design activities will maintain a high level of knowledge required for the civil engineer graduates and therefore the master courses are expected to have about 30 to 50% of the 1st cycle graduates enrolled into the 2nd cycle, though with a questionable rate of the budgeted students.

The reorganization of the high education in civil engineering is an ongoing process and changes as well as adaptations are expected in terms of curricula (modular courses), the specific regulations for entrance and graduation from the 1st cycle, and the acceptance of this bachelor degree among the European countries.

The student and staff mobility is slightly increased at our faculty due to the Socrates/Erasmus programs, by the increase of the number of the bilateral agreements. The international research programs/grants are opening in the recent years more opportunities for the master and doctoral students to perform exchange training programs and, thus, the Socrates/Erasmus programs can offer more openings to the students from the 1st cycle.

The training programs our faculty is providing in foreign languages favour an increased number of students joining civil engineering enabling them to enter the European labour market officially, by acknowledging their diploma, and in international companies performing in Romania on important complex projects.

The long term effects of the re-structured education in civil engineering are difficult to be foreseen and quantified at present. Given the economical trends, civil engineering is very much in demand on the labour market and the employment degree is favouring our graduates from the 1st cycle.

THE TRANSITION FROM AN INTEGRATED TO A TWO-TIER STUDY PROGRAMME AT THE TECHNICAL UNIVERSITY OF CIVIL ENGINEERING BUCHAREST – AN ITERATIVE PROCESS

Dan Stematiu[11], Iacint Manoliu[12]

1. INTRODUCTION

The transition to a new type of study programme, as result of the Bologna process will be better understood if one starts by presenting the main features of the study programme in use in the academic year 2004 - 2005.

First, a brief historical outline.

As in most countries, in Romania, too, engineering education started with civil engineering. Thus, in 1818 Gheorghe Lazăr founded in Bucharest a School for Land Surveyors which was followed by the creation in 1867 of a School of Bridges and Roads, transformed in 1888 into "The National School of Bridges and Roads". In 1921 it became the Polytechnic School of Bucharest. As a result of the Education Reform in 1948, the Faculty of Civil Engineering separated from the Polytechnic School and became an independent higher education establishment called the Civil Engineering Institute of Bucharest, while other faculties of the former Polytechnic School (in the field of mechanical engineering, electrical engineering, chemical engineering) formed the Polytechnic Institute of Bucharest. In 1994, the Civil Engineering institute adopted its present name: The Technical University of Civil Engineering of Bucharest, while the Polytechnic Institute was renamed University "Politehnica" of Bucharest.

In the academic year 2004 – 2005, the last year before the implementation of the two-tier system, there were two types of undergraduate programmes.

The long duration - 5 years - programme, leading to the degree named in Romanian "Inginer Diplomat" and considered to be equivalent to a M.Sc. degree in the anglo-saxon or two-tier system. This was an *integrated programme*, with no intermediary step.

The short duration - 3 years - programme, leading to the degree named in Romanian "Inginer Colegiu", considered to be equivalent to a B.Sc. degree in the anglo-saxon or two-tier system. Under conditions defined by the University Senate, a graduate of the 3-year programme could continue his/her education to become "*Inginer Diplomat*". This implied at least the equivalent of one-year

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[12] Professor, Technical University of Civil Engineering Bucharest

courses for the "bridge", after which admission was granted in the 3rd year of study of the long programme.

The long duration - 5-years programmes - were intended to educate graduates with strong knowledge and understanding in mathematics, science and engineering, able to solve complex civil engineering problems and to use the techniques, skills and modern engineering tools necessary for civil engineering practice.

The curricula of the engineering programmes of long duration for a given field (profile) comprised a "common trunk" or "common track" of five to six semesters (with scientific, basic engineering and "core" engineering subjects) followed by specialized engineering subjects which make the difference between various degree courses (specializations). Non-engineering subjects (economics, humanities, foreign languages, physical education etc) were also present in the curriculum, as well as two or three periods of practical training. The long duration programmes ended with a final examination, which included the presentation and defense of the diploma project. Graduates who successfully passed the final examination received the degree of "*Inginer Diplomat*", entitling them to go into practice without need for another professional recognition.

The short duration - 3-year programmes - were intended to educate graduates with know-how in civil engineering and construction engineering technology, able to show an independent judgment within the field of activity and to implement today's knowledge in the construction and operation of civil engineering works. The curricula of the engineering programmes of short duration was oriented toward practice. These programmes ended also with a final examination.

In the same academic year 2004 - 2005, there were two types of postgraduate programme, open only for the holders of "*Inginer Diplomat*" degree.

"*Advanced studies in engineering*" were introduced in 1994. This is a one-year postgraduate programme leading to the "*Diploma of advanced studies*". About 1/2 of the time was allocated to lectures and tutorials and 1/2 to research work and to the preparation of a Dissertation. The admission to the "*Advanced studies*" was made by examination. Candidates had to be holders of the degree of "*Inginer Diplomat*", with a good academic record. Up to 20% of the graduates of the 5-year programme could be admitted to the "*Advanced studies*" programme.

The Doctorate programme in engineering is open to holders of the "*Inginer Diplomat*" degree. The "*Diploma of advanced studies*" was not a prerequisite for admission but, definitely, was an asset at the entrance colloquium and also is taken into consideration when the programme of the doctoral candidate is established.

2. THE BOLOGNA PROCESS IN ROMANIA

A presentation of the "Bologna process" and on its impact on civil engineering education in Europe can be found elsewhere [1].

Of relevance for this paper is the "Action Line 2" of the Bologna Declaration, calling for the adoption of a system essentially based on two cycles.

Discussions concerning the introduction of the two-tier system in engineering education in Romania started after Sorbonne Declaration (May 1998), at university level or at national level, taking place mainly under the auspices of the National Council of Rectors, and became particularly vivid in the autumn of 2003, when a draft of a "*Law on the organisation of university studies*" became public.

After being adopted by both Chambers of the Parliament of Romania, the Law was promulgated on 24th June 2004 and became valid on 7th July 2004, as Law 288/ 2004.

2.1 Main provisions of the Law

- University studies in Romanian are organized in three cycles
- The first cycle, whith a duration of 3-4 years (180-240 ECTS Credits) is called *"Licența"* (synonime to *"Licence"* in French). *The Law stipulates that for the engineering education the first cycle is of **4 – year duration***. **The qualification level acquired by the graduates of the first cycle should be adequate for providing employability**.
- The second cycle, with a duration of 1-2 years (60-120 ECTS Credits), is called *"Master"*. The *cumulated duration* of the cycle I, Licence studies, and of the cycle II, Master studies, should correspond to **at least** 300 ECTS or 5 years. (The Consortium of Technical Universities in Romania agreed for a duration of **1.5 years** - 90 credits for the second cycle).
- A very important provision of the Law is found in the article stating that *for professions regulated by European norms, recommendations or good practice, universities can offer integrated programmes with a duration between 5 and 6 years, leading to diplomas equivalent to a Master degree diplomas.*
- The third cycle corresponds to *doctorate studies* having, normally, a duration of 3 years which, in justified cases (for instance experimental studies), can be extended with 1-2 additional years, pending the approval of the Senate of the university.
- The existing, short duration 3 - year programmes, are going to be dismantled, unless they can be transformed in programmes corresponding to the licence level (an option which is not going to be made in the

engineering field, where only one kind of first cycle programmes, of 4-year duration, will be offered).

The provisions of the law started to be applied in the academic year 2005-2006.

2.2 The need for a reform in engineering education

Although the system of engineering education existing in Romania in 2004 – 2005 was compatible with the Bologna spirit, there was, nevertheless, room for improvement, if one considered the positive and negative facets of programmes offered. Thus, there was a reality that the 3-year programmes offered by the university colleges were very unpopular, many colleges did not succeed to fill the places offered at the entrance examinations, and even if they did, the level of the recruited students was poor. At the same time, industry did not show too much interest in the graduates of the colleges. On the other hand, the year of "*Advanced studies*", a kind of *Post Master programme* (if the 5 year degree is assimilated to a Master), created mainly as a gate or step toward Doctoral studies, proved not to be so in most cases, since very few of the graduates of the programme eventually enrolled for the doctorate.

With the 3-year programmes out of the scene, a legitimate question was posed: could be, indeed, reasonable and necessary to educate **all** students through 5-year integrated programmes, with a marked design/ research character, when it is well known that only a minority will be actually employed after graduation in design/ research/ consultancy activities, while the others will work as contractors or in areas such as public administration, banking, insurance, IT etc? The need of a *"generalist"* type of civil engineer, educated in a shorter period of time, was quite obvious.

3. A "CASE STUDY" OFFERED BY TUCE BUCHAREST

Having in view the imminent change, during the academic year 2002/2003 a framework for the two-tier system (4 + 1.5) to be applied at TUCEB was established. The main provisions concerning the first cycle will be presented in what follows:

Duration: 4 years x 2 semesters = 8 semesters

Contact hours: 28 hours / week in the first 6 semesters, 30 hours/ week in the last 2 semesters, in total 236 hours

Diploma project: to be completed in the summer following the 4th year of study

Final examination: September – October, after the completion of eight semesters of study

The study plan comprises two parts:

a) a *"backbone"* spread on the entire period of study (not just a *"common trunk"* for a number of semesters), comprising subjects to be found in the curricula of **all specializations** pertaining to the civil engineering field.

b) a part for the *specialization*

The structure of the study plan given in the table 1 was approved by the Senate of TUCEB at the beginning or the academic year 2004 - 2005, to be considered by the faculties when devising the new curricula for the 4-year programmers.

Table 1. The backbone (74%)

No.	Group of subjects	Contact hours / % from total
1	Basic subjects	42 h (17.8%)
2	General technical education	53 h (22.5%)
3	General engineering education	52 h (22 %)
4	General economic and technological education	16h (7.2%)
5	Foreign languages, social sciences, humanities	12 h (5.1%)
	Total	**175 h / 74%**

For the group of subjects defining the specialization the number of contact hours is 61, that is 26% from the total.

It is worth to compare the curricula for a 4-year programme and for a 5-year programme. As object of the comparison was selected the specialization "*Structures*" at the "Department of Engineering in Foreign Languages", the unit of the University which is offering civil engineering education in English and in French.

To better assess the differences, let us define first the framework for the former 5-year programme:

Duration: 5 years x 2 semesters = 10 semesters

Contact hours: between 27 and 29 hours/ semester, in total 251 hours

Diploma project: to be completed in the 10th semester, which is entirely devoted to this activity

Final examination: in June at the end of the tenth semester

In the table 2 are presented in parallel, in two columns, one for each type of programme, the subjects corresponding to the 5 groups of subjects defined in the table 1 and, in addition, the subjects for the specialization "*Structures*".

Table 2. Comparison between programmes

4-year		**5-year**	
Basic subjects 42 h (17.8%)		**Basic subjects 52h (20.7%)**	
Linear algebra & analytical geometry	5	Linear algebra & analytical geometry	7
Analysis I, II	8	Analysis I, II	10
Differential equations	4	Advanced mathematics	4
Physics I, II	8	Numerical analysis	4

Chemistry	3	Physics I, II	7
Descriptive geometry	4	Chemistry	3
Computer science	3	Descriptive geometry I, II	5
Programming languages	3	Computer science	4
Info graphics	4	Programming languages	4
		Computer methods in civil engineering	4
General technical education 53 h (22.5%)		**General technical education 70 h (27.9%)**	
Engineering graphics I, II	4	Engineering graphics I, II	4
Mechanics I, II	9	Mechanics I, II	10
Strength of materials I, II	11	Strength of materials I, II	12
Structural analysis I, II	9	Structural analysis I, II	11
Structural dynamics and elements of earthquake engineering	5	Structural dynamics	5
Hydraulics	4	Earthquake engineering	4
Soil Mechanics	5	Fluid mechanics I, II	8
Elements of Theory of Elasticity	3	Soil Mechanics I, II	8
Introduction to FEM	3	Elasticity and plasticity	4
		Finite element method	4
General engineering education 52 h (22%)		**General engineering education 60 h (23.9%)**	
Surveying	4	Surveying	4
Civil engineering materials	5	Civil engineering materials	5
Engineering geology	3	Engineering geology	3
Elements of architecture	2	Elements of architecture	2
Reinforced and prestressed concrete I, II	8	Reinforced and prestressed concrete I, II	10
Buildings I	3	Buildings I	5
Transport engineering	4	Transport engineering	3
Wood structures	4	Bridges	4
Sanitary engineering	3	River basin planning	3
Equipments for buildings	3	Sanitary engineering	4
Foundation engineering	5	Equipments for buildings I, II	4
Steel structures I	4	Wood structures	3
Environmental engineering	2	Foundation engineering	5
Underground structures	2	Steel structures I	5
General economic and technological education 16h (6.7%)		**General economic and technological education 16h (6.4%)**	
Economy and legislation	4	Enterprise economics	2
Construction management I	3	Construction management	6
Construction engineering I	3	Construction engineering	6
Construction machines	3	Construction machines	2
Foreign languages, social sciences, humanities 12h (5.1%)		**Foreign languages, social sciences, humanities 14h (5.6%)**	
Foreign languages I, II, III, IV	6	Foreign languages I, II, III, IV	10
Social sciences, humanities I, II	6	Social sciences, humanities I, II	4
Specialization in structures 61h (25.8%)		**Specialization in structures 39 h (15.5 %)**	
Reinforced concrete structures I, II	12	Reinforced concrete structures I, II	12
Buildings II, III	12	Steel structures II	4

Masonry mechanics	4	Advanced steel design	6
Composite and associate materials	2	Building design	6
Steel structures II, III	12	Structural reliability and risk analysis	3
Construction management II	5	Non-linear analysis of structures	3
Construction engineering II	5		
Marketing	4		
Structural reliability	5		

4. A NEW VARIANT INTRODUCED IN 2006 - 2007

The experience of only one-year following the introduction of the new 4-year programme proved to be sufficient for making several changes, which are summarized in the table 3.

Table 3. Comparison between the frameworks for 5-year integrated programs and for the first cycle, 4-year programmes (2005 – 2006, 2006 – 2007)

Item	**5-year programmes**	**4-year programmes**	
		2005 - 2006	**2006 - 2007**
Duration	10 semesters	8 semesters	8 semesters
Contact hours	between 27 and 29 hrs/sem, in total 251 hrs	between 28 and 30 hrs/sem, in total 236 hrs	between 25 and 28 hrs/sem, in total 218 hrs
Diploma project	To be completed in the 10th semester	To be completed in the summer after the 8th semester	
Final examination	End of June, at the end of 10th semester	End of September, after the completion of the 8th semester of study	

As a result of the reduction in the total number of hours, the quotas affected to various groups of subjects were also affected as shown in the table 4.
In the table 5 the comparison between the initial 4-year programme (2005 – 2006) and the new one (2006 – 2007) is extended at the level of groups of subjects.

Table 4.

No	**Group of subjects** *The "backbone"*	**Contact hours/ % from total**	
		2005 - 2006	**2006 - 2007**
1.	Basic subjects	42 h (17.8 %)	38 h (17.4 %)
2.	General technical education	53 h (22.5 %)	55 h (25.2 %)
3.	General engineering education	52 h (22 %)	46 h (21.1 %)
4.	General economic and technological education	16h (7.2 %)	10h (4.6 %)
5.	Foreign languages, social sciences, humanities	12 h (5.1 %)	14 h (6.4 %)
	Total	**175 h / 74%**	**163 h / 74.7%**
6.	The specialization	61 h (26 %)	55h (25.3 %)
	Grand total	**236 h (100 %)**	**218 h (100%)**

Table 5. Comparison between the two 4-year programmes

No	Basic subjects	2005 - 2006	2006 - 2007
		42 h (17.8%)	**38 h (17.4%)**
	Linear algebra & analytical geometry	5	5
	Analysis I, II	8	8
	Differential equations	4	4
	Physics I, II	8	8
	Chemistry	3	3
	Descriptive geometry	4	4
	Computer science	3	3
	Programming languages	3	
	Info graphics	4	3
General technical education		**2005 - 2006**	**2006 - 2007**
		53 h (22.5%)	**55 h (25.2%)**
	Engineering graphics I, II	4	3
	Mechanics I, II	9	9
	Strength of materials I, II	11	11
	Structural analysis I, II	9	10
	Structural dynamics and elements of earthquake engineering	5	5
	Hydraulics	4	4
	Soil Mechanics	5	5
	Plates and shells. Elements of ET		2
	Elements of Theory of Elasticity	3	
	Introduction to FEM	3	3
	Computer Assisted Design		3
General engineering education		**2005 - 2006**	**2006 - 2007**
		52 h (22%)	**46 h (21.1%)**
	Surveying	4	4
	Civil engineering materials	5	5
	Engineering geology	3	2
	Elements of architecture	2	2
	Reinforced and prestressed concrete I, II	8	7
	Buildings I	3	4
	Transport engineering	4	4
	Wood structures	4	4
	Sanitary engineering	3	3
	Equipments for buildings	3	2
	Foundation engineering	5	5
	Steel structures I	4	4
	Environmental engineering	2	
	Underground structures	2	
General economic and technological education		**2005 - 2006**	**2006 - 2007**
		16h (6.7%)	**10h (4.6%)**
	Economy and legislation	4	3
	Construction management I	3	3
	Construction technology I	3	4
	Construction engineering II	3	
	Construction machines	3	

Foreign languages, social sciences, humanities		2005 - 2006	2006 - 2007
		12h (5.1%)	14h (6.4%)
	Foreign languages I, II, III, IV	6	8
	Social sciences, humanities I, II	6	6
Specialization in structures		2005 - 2006	2006 - 2007
		61h (26%)	55h (25.3%)
	Reinforced concrete structures I, II	12	12
	Buildings II, III	12	11
	Masonry mechanics	4	3
	Composite and associate materials	2	2
	Steel structures II, III	12	11
	Construction management II	5	5
	Construction engineering II	5	4
	Building equipment		4
	Marketing	4	
	Structural reliability	5	3

5. CONCLUSION

The main conclusion which can be drawn from examining the 4-year programme as it is applied since 2006 – 2007 is that the degree awarded after the completion of the programme will be relevant for the European labour market on a appropriate level of qualification. A programme in which 3/4 of the contact hours is reserved to "*core subjects*", i.e. subjects common for the entire field, regardless of specialization, is, definitely, aimed at educating a "generalist" type of civil engineer. At the same time, the first cycle degree will also represent a solid base for pursuing a higher qualification through a Master degree, be it a more academic-oriented Master or a more professionally-oriented Master.

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THE NEW FIRST CYCLE DEGREE PROGRAMMES IN CIVIL ENGINEERING AT SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA

J. Dický [13]

1. GENERAL VIEW ON THE CIVIL ENGINEERING EDUCATION AT STU IN BRATISLAVA

Students enter the Faculty of Civil Engineering at Slovak University of Technology in Bratislava after at least twelve years of their previous study and the successful completion of secondary school obtaining the school leaving certificate, usually at the age 18 or 19 years. The university applicants usually recruit from grammar schools, less frequently from some types of specialised or vocational schools.

A new system of study introduced at the faculty after 1989 has recently been further updated to a credit-based modular-unit system. The first part of this system, three to four years courses (180 to 240 credits), leads to a bachelor′s degree. It gives the student the theoretical background necessary for further specialization together with the basics of civil engineering. To broaden the students′ perspectives, courses in the arts and social sciences, including philosophy, sociology, law, psychology and aesthetic, were added to the curricula. The second part of the system, which is aimed at developing special skills in the chosen pathway, is completed by a thesis. Its successful completion results in the award of the Diploma in Civil Engineering - an M. Sc. equivalent degree. This part lasts two years (120 credits) and permits students to implement their individual goals for their vocational education and specialization. According to the Higher Education Law, the Ministry of Education prepared in 2003 the list of official branches of university studies. Professors from the faculty were charged with preparing the obligatory content of six branches. After contents of all branches were prepared and accredited, all faculties were asked for the preparation of programmes within the frame of these branches including the requirements of content, in bachelor study at least 3/5, in master study at least 1/2 of accredited content. The amount of contact hours was fixed to 25 hours in bachelor and 23 hours in master study per week. Each University in Slovak Republic had to apply the State Accreditation Commission for an accreditation of all study programmes. After successful

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accreditation the University got full academic authorisation to provide the studies in these programmes. Our Faculty asked for the accreditation 8 bachelor, 25 master and 15 doctoral study programmes. The new programmes started in academic year 2004/2005 in following programmes:

BACHELORS STUDY

Eight branches:

- Civil and Transportation Engineering
- Water Management and Water Structures
- Surveying and Cartography
- Building Structures & Architecture
- Environmental Engineering
- Technology & Management of Buildings
- Civil Engineering (in English)
- Mathematical & Computational Modelling

MASTERS STUDY

Twenty two branches:

- Civil Engineering & Structures
- Transportation Engineering
- Urban Eengineering
- Building Engineering & Structures
- Environmental Engineering
- Water Resources Management
- Sanitary Engineering
- Hydraulic Structures
- Landscape Engineering
- Geodesy & Cartography
- Architectonic Structures & Design
- Buildings & Environment
- Buildings Services
- Technology of Building Environment
- Buildings Services
- Building Structures & Architecture
- Economics and Building Industry Management
- Building Technology
- Material Engineering
- Building & Environment
- Civil Engineering (in English)
- Mathematical & Computational Modelling

2. CIVIL ENGINEERING EDUCATION AT UNDERGRADUATE LEVEL

BSc. Level
Title awarded: Bachelor of Civil Engineering

Admission	The University is responsible for the rules of admission. The minimum requirements are based on the pre-university certificate level. Most applicants pass the university entrance exam mainly on mathematics and physics.							
Duration of study	3 years (in one programme 4 years)							
Course organisation	Two semesters in each year of study: • So called "winter" semester (lectures from October to January)- duration 13 weeks, • so called "summer" semester (lectures from March to June) - duration 13 weeks.							
Examination	Two sessions: • after "winter" semester duration 4 - 6 weeks, • after "summer" semester duration 5 - 6 weeks.							
Teaching organisation	The programmes consist of 30-35 subjects (10-12 each year). The lectures, exercises and laboratory are taught in 25 - 28 contact hours per week, 40 - 45% lectures, 60 - 55% exercises and laboratory.							
Final exam	The final exam comprises: • presentation of the short final project, • the exam from one core subject. The final assessment consists of average mark of all subjects assessed during study, the mark of final project and the mark of final exam.							
The weight of subject categories	A	B	C	D	E	F	G	*H*
	10-12%	9-13%	17-23%	23-35%	5-8%	8-12%	0-5%	5%

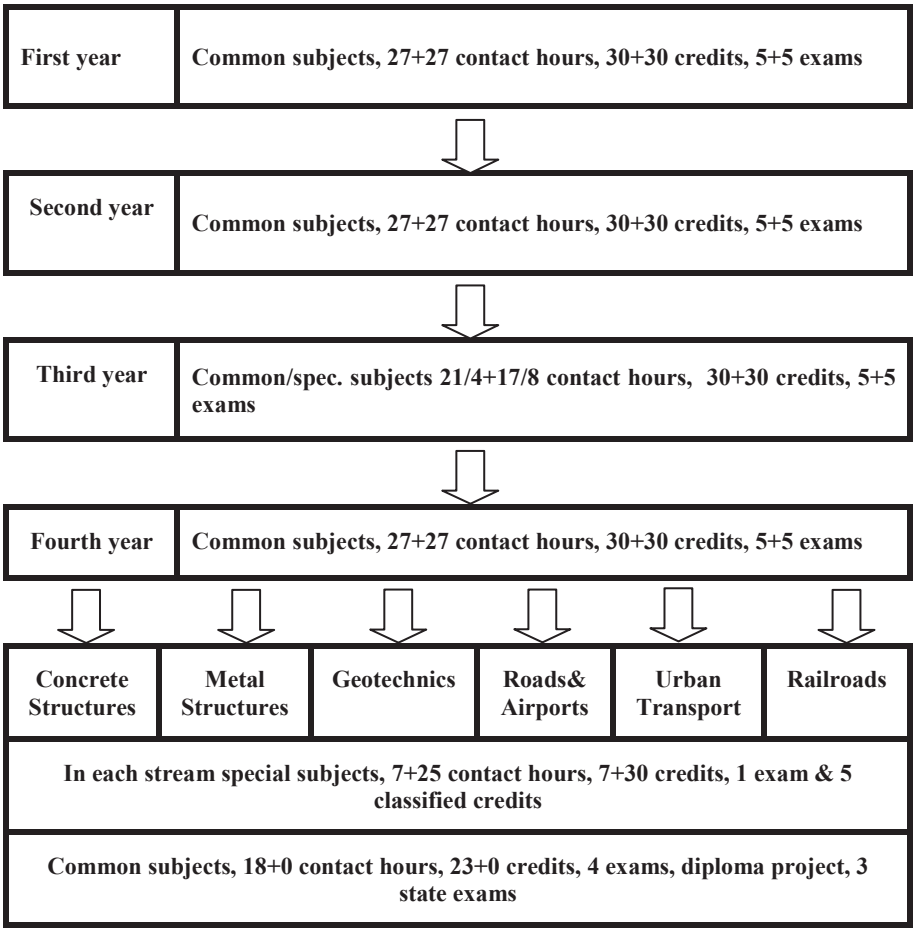
Subject categories:

A Basic Sciences
B Engineering Sciences
C Core Civil Engineering Subjects
D Specialised Civil Engineering Subjects
E Economics and Management
F Non-technical Subjects
G Practical Industrial Placement
F Final Project/Thesis

3. EXPERIENCE WITH INTRODUCING NEW CIVIL ENGINNERING PROGRAMMES AT BACHELOR STAGE

The Civil and Transportation Engineering Programme (CTEP), taught at the faculty from the very beginning of its establishing in 1938, is one of most important programmes because of preparing experts in statics and dynamics of buildings and engineering structures. During the history it changed many times its content as well as the schedule. All programmes taught in 1996/97 were structured as one stage programmes. As it is clear from the scheme, the CTEP programme was organized in one stream from first to fourth year. The small diversity started only in fourth year of study by one or two optional subjects. The fifth year was organized in six streams, each with about 60% of common subjects and about 40% of different subjects.

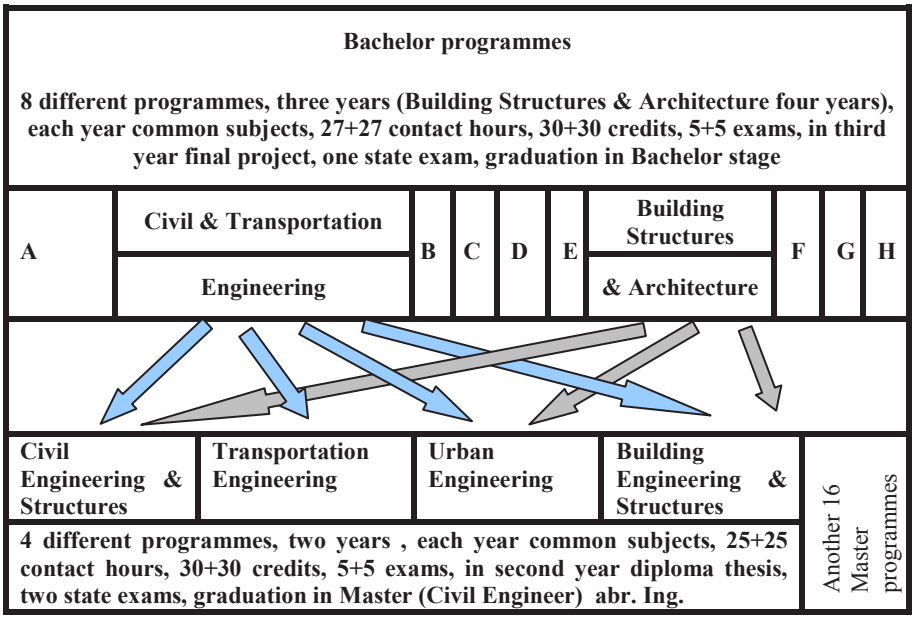
The scheme presented below shows the structures of programme taught in 1996/97.



One of the main aims of the faculty when introducing the new two-stage system was to give students more freedom in organizing their curricula. Finishing the bachelor degree a student has more possibilities in continuing its study in engineering programmes.

The first stage is the undergraduate course providing the education in basic civil engineering branches with the three years duration (180 credits) completed by a final thesis awarded with BSc. degree. The minimum requirements for admission are based on the pre-university certificate level. All applicants pass the university entrance exam mainly on mathematics and physics. This stage gives the student the theoretical background necessary for further branch together with the basics of civil engineering. To broaden the students´ educational perspectives, courses in the arts and social sciences, including laws, philosophy, sociology, psychology and aesthetics, have been added to the curricula. There are two semesters in each year of study - winter semester (13 weeks lectures from October to January) ensued by 6 weeks session, and summer semester (13 weeks lectures from March to June) ensued by 8 weeks session. The programmes consist of 30-35 subjects (10-12 each year). The lectures, exercises and laboratory are taught in 28 contact hours per week, 50% lectures, 50% exercises and laboratory. The final exam comprises the presentation of the short final project and the exam from one of the core subjects. The final assessment consists of average mark of all subjects assessed during study, the mark of final project and the mark of final exam.

The next scheme shows the possible ways in continuing civil engineering studies in programmes taught in and 2006/07.



The second stage - the post-graduate course providing the continual education in eight specialised engineering branches with two years duration (120 credits) aimed at developing special skills in the chosen specialisation, is completed by a diploma thesis and awarded with MSc. degree. It permits students to implement their individual goals for their vocational education and specialisation. Students are enrolled either after completing their BSc. studies in Civil Engineering branch or BSc graduates from earlier period on the base of their final studies mark and the interview. There are two semesters in first and second year of study - winter semester (13 weeks lectures from October to January) ensued by 6 weeks session, and summer semester (13 weeks lectures from March to June in first year and 8 weeks lectures from March to May in second year) ensued by 8 weeks session. The programmes consist of 20-24 subjects (10-12 each year). The lectures, exercises and laboratory are taught in 26 contact hours per week, 40% lectures, 60% exercises and laboratory. The final exam comprises the presentation of the diploma project and the exam from two core subjects. The final assessment consists of average mark of all subjects assessed during study, the mark of diploma project and the marks of final exams. Thereafter, three-year PhD. study programmes in ten major civil engineering sciences are offered to students with the MSc degree.

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EXPERIENCE WITH IMPLEMENTATION OF THE TWO-TIER SYSTEM IN CIVIL ENGINEERING EDUCATION AT UNIVERSITY OF ZILINA

Josef Vičan[14], Ján Bujňák[15]

1. INTRODUCTION

The two-tier study system respecting the Bologna process has been implemented in the educational system of the Civil Engineering Faculty at University of Žilina in 2003, so that the first graduates of the second degree of study were finishing in 2008. In accordance with the Slovak law 131/2002, which introduced the two-tier study system in Slovakia in 2002, the length of the first cycle, i.e. bachelor study was predetermined on 3 or 4 years and the length of the master study was fixed on 2 years. This law mentioned above standardised also the third degree of the education – doctoral study, whose minimum length was established on 3 years.

The creation of knowledge cores valid for individual study specialisation was the first step of the implementation of the two-tier study programmes in Slovak educational system. It was the general basis for preparation of two-tier study programmes, because every new study program had to respect the knowledge core of individual study specialisation at least of 60 %. This decision of the Accreditation Committee of the Slovak Republic allowed developing the more variable study programmes at three Civil Engineering Faculties in Slovakia.

At the Faculty of Civil Engineering, University of Žilina, the special attention was paid to the preparation of the bachelor study programmes. The effort was to create balanced study programmes of the first study degree, either to prepare bachelors to be employable in building industry or to continue the second study degree of engineering study. Respecting this effort, we have developed study programmes based on the principle of fifty-fifty, where the weight of theoretical background of courses was equal to the weight of the technical and professional courses. Results of our effort can be seen in Table 2, where the bachelor study program for Civil Engineering is presented. Beside this study program, also the curricula for Buildings, Technology and Management of Buildings and Transport Planning were developed. All these

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study programmes respect the minimal knowledge set (cores) of individual specialisations and the aforementioned basic principle of the study program development. From the viewpoint of the study length, it is necessary to underline that all study programmes are three-year programmes. Only exception is study program for Buildings, whose length is 4 years. Review of all study programmes developed at the Faculty of Civil Engineering, University of Žilina in the first stage of two-tier study implementation is presented in Table 1.

Application of the above mentioned principle caused decreased extent of theoretical courses compared to the previous integrated system of engineering education at our Faculty. To preserve theoretical knowledge of future engineers finishing two-tier study system, some parts of theoretical subjects (Mathematics, Static, Dynamic, Elasticity and Plasticity and others) had to be removed to the second-degree study programmes – to the engineering study. There was also the rule of the Accreditation Committee in Slovakia, to respect maximum 25 study hours per week. From the viewpoint of these principles, the development of bachelor study programmes was very complicated and time demanding process. Actually, in this year the process of two-tier study system creation has continued by preparation of new curricula for all study programmes presented in Table 1 because of complex accreditation of the Faculty of Civil Engineering in the year 2008.

Table 1. Study programmes of Civil Engineering Faculty in Žilina

<table>
<tr><th rowspan="2">Study specialization</th><th colspan="3">Study programmes</th><th rowspan="2">Notice</th></tr>
<tr><th>1st degree (3 years)</th><th>2nd degree (2 years)</th><th>3rd degree (3-years)</th></tr>
<tr><td rowspan="2">5.1.5 Structural and Transportation Engineering</td><td rowspan="3">Civil Engineering</td><td>Railway Engineering</td><td rowspan="3">Theory and Structures of Structural Engineering</td><td rowspan="2"></td></tr>
<tr><td>Road Engineering</td></tr>
<tr><td>Bridges and Tunnels</td><td></td></tr>
<tr><td>Transportation Planning</td><td>Transportation Planning</td><td>Transportation Planning</td><td>Combined study</td></tr>
<tr><td>5.1.4 Buildings</td><td>Buildings (4-years study)</td><td>Bearing Structures of Buildings</td><td></td><td></td></tr>
<tr><td>5.2.8 Building Industry</td><td>Technology and Management of Constructions</td><td>Technology and Management of Constructions</td><td>Technology and Management of Constructions</td><td></td></tr>
</table>

Table 2. Civil Engineering Programme

Study specialisation 5.1.5.: Structural and Transportation Engineering
Study programme: Civil Engineering

Obligatory Courses	1.semester			2.semester			3.semester			4.semester			5.semester			6.semester		
	Lec.	Sem.	C	Lec.	Sem.	C	Lec.	Sem.	C	Lec.	Sem.	C	Lec.	Sem.	C	Lec.	Sem.	C
Mathematics I, II	3	3	**7**	2	2	**6**												
Descriptive Geometry	2	2	**5**															
Building Materials	2	2	**5**															
Geology	2	2	**5**															
Urban Design and Planning	2	2	**5**															
Physics				2	2	**6**												
Hydraulics				2	2	**6**												
Structural Mechanics				3	3	**8**	2	2	**6**									
Theory of Elasticity							3	2	**6**									
Economics and Management							2	2	**4**									
Soil Mechanics							2	2	**5**									
Surveying							2	2	**5**									
Foundation of Structures										2	2	**5**						
Engineeering Geology										2	1	**4**						
Building Structures										2	0	**3**						
Timber Structures										2	2	**5**						
Masonnry Structures										2	2	**5**						
Project - Building Structures										0	2	**2**						
Concrete Structures													2	2	**5**			
Technology of Building Processes													2	1	**3**			
Steel Structures													2	2	**5**			
Road Engineering I													2	2	**4**			
Railway Engineering I													2	2	**5**			
Project - Engineering Structures													0	2	**3**			
Fieldwork - Surveying										1w		**2**						
Practice										1w		**2**						
Construction Management																2	2	**4**
Road Engineering II																2	2	**4**
Railway Engineering II																2	2	**4**
Concrete Bridges																2	2	**4**
Steel Bridges																2	2	**4**
Bachelor Thesis																0	4	**8**
Elective Courses			**3**			**4**			**4**			**2**			**5**			**2**
Number of hours and credits	**11**	**11**	**30**	**9**	**9**	**30**	**11**	**10**	**30**	**10**	**9**	**30**	**10**	**11**	**30**	**10**	**14**	**30**

Elective Courses																		
Mathematics Seminary	0	2	**2**	0	2	**2**												
Building Chemistry	2	1	**2**															
History of Architecture	2	0	**2**															
Chapters of Physics				0	2	**2**												
Engineering Networks				2	1	**4**												
Soil Mechanics Laboratory							0	2	**2**									
Water Engineering							2	2	**4**									
Aesthetics										0	2	**2**						
Psychology										1	1	**2**						
Transportation Engineering													2	2	**5**			
Economics and Management II													2	2	**5**			
Underground Structures																2	2	**5**
CAD/CAM/CAE										0	2	**2**	0	2	**2**	0	2	**2**
Foreign Language	2	2	**2**	2	2	**2**	2	2	**2**	2	2	**2**	2	2	**2**	2	2	**2**
Physical Training	0	2	**1**	0	2	**1**	0	2	**1**	0	2	**1**	0	2	**1**	0	2	**1**

Final Exams

Obligatory: Structural Mechanics

Elective * *: Concrete Structures, Concrete Bridges,Steel Structures, Steel Bridges, Road Engineering, Railway Engineering, Soil Mechanics, Economycs of Building Industry, Technology of Building Processes*

* Two subjects should be elected

2. BASIC PROBLEMS OF THE BACHELOR STUDY

After finishing the first cycle of the bachelor study, the following principal problems of study could be identified:

1. Minimum amount of students finishing the bachelor study are ready to leave University and to be employed on labour market;
2. The length of the bachelor study according to study programme in Table 2 (3 years) seems to be rather short and generally students have problem to finish it in the determined time;
3. The only six semesters long study is especially very time demanding for preparation of the bachelor thesis during the last semester, thus many students finish the final exam in the alternate term in September or have to repeat the third year of the study;

The first mentioned problem indicates that the bachelor degree is rather new at Slovak labour market, therefore majority of students wish to continue and to finish the second degree and to obtain well-known and popular engineering degree.

From the viewpoint of this problem, there is also deficiency of the basic philosophy of the bachelor study programmes structure, because it was based on the principle of equilibrium between courses with the theoretical background and the professional as well as technical subjects. If the situation on the Slovak labour market would not change in the short time period, it would be necessary to correct actual approach to the curricula structure from the viewpoint of the study rearrangement in order to strengthen theoretical courses in the bachelor study.

As it was mentioned in the second and third points, the bachelor study in the proposed length of three years seems to be very short and students studying the Civil Engineering study programme have problems to finish study programme at planned time. The reasons, which cause these problems, are as follows:

- Inappropriate arrangement of the study programme in the last two semesters, where many professional time consuming courses are to be followed;
- Working on bachelor thesis during the last semester, which is also necessary to absolve in the limited period;
- Bad knowledge level of bachelor students due to lack of interest of young people to study technical specialisations.

The given problems could be eliminated through the reorganization of the study programme in two last semesters by moving some time consuming courses to the previous semesters or to the second-degree study programmes. Furthermore, a possibility exists to begin with the elaborating bachelor thesis earlier, e.g. at the beginning of the fifth semester. In this way students could have much more time to prepare their bachelor thesis.

In frame of preparation of all study programmes for accreditation in 2008, some modification of the Civil Engineering study programme presented in Table 2 was done and the adjusted study programme for Civil Engineering bachelor study was created, which is presented in Table 3. As can be seen in Table 3, the problem of inappropriate study arrangement in the last two semesters was partially solved. Especially, relatively complicated courses like steel or concrete bridges were transfered to the engineering part of study. Only informative subject Bridges remains in the last semester to give the most relevant information about the important constructions of the transport infrastructure.

However, the essential problem remains. This is very low knowledge level of bachelor students. The deficiency is not only problem of previous education at the secondary schools, but also problem of the low interest of the contemporary young population on technical education, so that the better students prefer to choose other field of studies. Especially humanitarian, juridical and economic specialisations are very attractive for young population. This is incomprehensible and rather surprising reality from the viewpoint of the actual building activities offering very good job opportunities.

The solution of the problem is very complicated due to global social situation and the policy of the Slovak government. Therefore, we are finding another possibility to help bachelor students to finish successfully their study. There is also a possibility to extend the bachelor study to 3,5 or 4 years. Such situation already exists in the field of study of Buildings, where the study period was established to 4 years. However, the solution means another problem, which is extending global study length to 5,5 or 6 years, so that the proposed solution is not very popular from the viewpoint of Slovak government and state budget. Therefore, it is necessary permanent finding the optimal study arrangement and the optimal course curricula to make easy and more popular the bachelor study of Civil Engineering.

3. THE SECOND DEGREE STUDY

The length of the second degree study (master study) was fixed on 2 years in accordance with the Slovak law 131/2002. For accreditation in 2009, all the study programmes presented in Table 1 were prepared except of the study programme Transportation Planning due to problem of guarantee of this programme. The aforesaid changes in the bachelor study mean also adjustment and reorganisation of the master study programmes. For specialisation of Structural and Transportation Engineering, which study programmes of the second degree study are presented in Table 1, the study arrangement is shown in Table 4 in the case of programme Bridges and Tunnels.

Table 3. Adjusted Civil Engineering Programme

Study Specialisation **5.1.5. Structural and Transportation Engineering**
Study Programme **Civil Engineering**

Obligatory Courses	1. semester			2. semester			3. semester			4. semester			5. semester			6. semester		
	Lec	Sem	Cr	Lec	Sem	Cr	Lec	Sem	Cr	Lec	Sem	Cr	Lec	Sem	Cr	Lec	Sem	Cr
Mathematics I	3	3	7															
Descriptive Geometry	2	2	5															
Buildings Material	2	2	5															
Geology	2	2	5															
Urban Design and Planning	2	2	5															
Mathematics II				2	2	6												
Physics				2	2	5												
Hydraulics				2	2	5												
Static of Structures				2	4	7												
Structural Mechanics							2	2	5									
Theory of Elasticity and Plasticity							3	2	6									
Soil Mechanics							2	3	5									
Buildings Structures							2	2	5									
Economics of Building							2	2	5									
Foundation of Structures										2	2	5						
Steel Structures										2	2	5						
Concrete Structures										2	2	5						
Surveying I										2	2	5						
Project - Building Structures										0	2	3						
Fieldwork - Surveying											1 w	2						
Practise											1 w	1						
Project - Transport Structures													0	2	3			
Engineering Geology													2	2	5			
Transportation Engineering													2	2	5			
Road Engineering I													2	2	5			
Railway Engineering II													2	2	5			
Construction Technology																2	1	4
Bridges																2	1	4
Construction Management																2	2	5
Bachelor Thesis																0	4	8
Elective courses			3			7			4			4			7			9
Number hours and credits	11	11	30	8	10	30	11	11	30	8	10	30	8	10	30	6	8	30
	22 + e			18 + e			22 + e			18 + e			18 + e			14 + e		
Elective courses																		
Building Chemistry	2	1	3															
Mathematics Seminary	0	2	2	0	2	2												
Chapters of Physics				0	2	2												
Machine Programming				1	2	3	0	2	2									
Ethics				0	2	1												
Engineering Networks							2	1	3									
Basis of Design and Actions on Structures							2	1	4									
Internet							0	2	1									
Water Engineering										2	2	5						
CAD/CAM/CAE I,II										0	2	2	0	2	2			
Foreign Language										0	2	2	0	2	2	0	2	2
Surveying II													2	2	5			
Timber Structures													2	2	5			
Masonry Structures													2	2	5			
Aesthetics													0	2	1			
Building Law																2	1	3
Road Engineering II																2	2	5
Railway Engineering II																2	2	5
Physical Training	0	2	1	0	2	1	0	2	1	0	2	1	0	2	1	0	2	1
Final Exams																		
Obligatory	Structural Mechanics																	
Elective*	Concrete Structures, Road Engineering, Railway Engineering, Steel Structures,																	
*Two subjects should be elected	Economics of Building, Soil Mechanics, Construction Technology																	

Table 4. Bridges and Tunnels Programme

Name of course unit (in English)	Year of study	Type C/E/F *	Contact hours					ECTS credits
			Total contact hours	From which spent on				
				L	CL	LAB	P	
Applied Mathematics	1	C	4	2	2			5
Elasticity and Plasticity	1	C	4	2	2			5
Concrete Structures	1	C	4	2	2			5
Steel Structures	1	C	4	2	2			5
Structural mechanics	1	C	4	2	2			5
Tunnels 1	1	C	4	2	2			5
Concrete Bridges 1	1	C	4	2	2			5
Steel Bridges 1	1	C	4	2	2			5
Bridges – Project	1	C	2				2	3
Structural Reliability	1	C	2	1	1			3
Structural Dynamics	1	C	4	2	2			5
Practice	1	C	2					1
Excursion	1	C	1					1
Engineering Geology	1	E	4	2	2			5
Pavement Mechanics	1	E	4	2	2			5
Combine Transport	1	E	4	2	2			4
Airports	1	E	4	2	2			4
FEM	1	E	4	2	2			5
Composite Structures	1	E	4	2	2			5
Structural Stability and Plasticity	1	E	4	2	2			5
CAD/CAM/CAE 1	1	E	2			2		2
Urban Communications	1	E	3	2	1			4
Infrastructure Planning	1	E	3	2	1			3
Material Engineering	1	E	4	2		2		4
CAD/CAM/CAE 2	1	E	2			2		2
Experimental Analysis	1	E	3	2		1		4
Tunnels 2	2	C	4	2	2			5
Steel Bridges 2	2	C	4	2	2			5
Concrete Bridges 2	2	C	4	2	2			5
Bridges – Project 2	2	C	2				2	3
Steel Bridges 3	2	C	2	2				5
Concrete Bridges 3	2	C	4	2	2			5
Project Management	2	C	4	2	2			5
Selected Geotechnical Courses	2	C	4	2		2		5
Diploma Thesis	2	C	6				6	12
EIA	2	E	3	2	1			4
Quality Management	2	E	3	2	1			4
Timber Structures and Bridges	2	E	4	2	2			4
Urban Railways	2	E	4	2	2			4
Masonry Structures 2	2	E	4	2	2			5
Structural Dynamics 2	2	E	4	2	2			5
Transport Management	2	E	4	2	2			5

Name of course unit (in English)	Year of study	Type C/E/F *	Contact hours					ECTS credits
			Total contact hours	From which spent on				
				L	CL	LAB	P	
System								
Intelligent Transport System	2	E	3	2	1			4
Personal Management	2	E	2	2				3
Building Law	2	E	2	2				3
Physical Training	1, 2	F	2		2			1

* C = Compulsory; E=elective; F=facultative
** L - lectures; CL – class work; LAB – laboratory work; P – project;

The study arrangement of the programme Bridges and Tunnels seems to be optimal, because students do not sign any problems. The concurrent working up of Diploma thesis and attending the study courses during the last semester was solved in such a way, that students use the course Bridges-Project 2 for preparation of their Diploma work.

4. CONCLUSIONS

The paper shortly describes problems with the implementation of Bologna process in the educational system of the Faculty of Civil Engineering, University of Žilina. General problems related to bachelor study degree are presented together with solution suggestions. Concurrently, the review of study programmes taught at Faculty of Civil Engineering, University of Žilina is presented together with the curricula of the bachelor study programme of Civil Engineering and master study programme of Bridges and Tunnels.

ANNEX II

Civil Engineering Master programmes in Europe – a EUCEET III Survey

Questionnaire –

EUCEET survey on Master programmes

	General information	
0.1	Higher education institution	
0.1.1	Name of the institution	
	- in original language	
	- in English	
0.1.2	Name of the Faculty/ Department awarding the qualification	
0.1.3	City	
0.1.4	Country	
0.1.5	www address of the institution	
0.1.6	Does the www site contain the curricula of Master or Master-type programmes	YES/NO
0.2	Respondent	
0.2.1	First name and surname	
0.2.2	Position in the institution of the respondent	
0.2.3	e-mail	
0.2.4	Telephone number	
0.2.5	Fax number	

Part I. Consecutive Master programmes

I.1 Information on the programmes

I.1.1	Name of the qualification (title, degree) awarded	
	- in original language	
	- in English	
I.1.2	Nominal (legal) duration in years	
I.1.3	Total ECTS credits required (if applicable)	
I.1.4	Type of programmes (please tick the corresponding type)	
	Taught Consecutive Master	
	Taught & Research Consecutive Master	

I.1.5	How many Consecutive Master programmes are offered by your Faculty/Department	
I.1.6	Names of the degree courses (specializations) offered as Consecutive Master	
I.1.6.1	- in original language	
	- in English	
I.1.6.2	- in original language	
	- in English	
I.1.6.3	- in original language	
	- in English	
	please continue, to provide the full list of degree courses offered as Consecutive Master	
I.1.6.4		

I.2 Three sample curricula for Consecutive Masters

A. Name of the Consecutive Master (in English)

……..

Crt. No.	Name of course unit (in English)	Year of study	Type C/E/F *	Contact hours					ECTS credits
				Total contact hours	From which spent on **				
					L	CL	LAB	P	

*** C = Compulsory; E=elective; F=facultative**

**** L - lectures; CL – class work; LAB – laboratory work; P – project;**

B. Name of the Consecutive Master (in English) ……

Crt. No.	Name of course unit (in English)	Year of study	Type C/E/F *	Contact hours					ECTS credits
				Total contact hours	From which spent on **				
					L	CL	LAB	P	

*** C = Compulsory; E=elective; F=facultative**

**** L - lectures; CL – class work; LAB – laboratory work; P – project;**

C. Name of the Consecutive Master (in English) ……

Crt. No.	Name of course unit (in English)	Year of study	Type C/E/F *	Contact hours					ECTS credits
				Total contact hours	From which spent on **				
					L	CL	LAB	P	

*** C = Compulsory; E=elective; F=facultative**
**** L - lectures; CL – class work; LAB – laboratory work; P – project;**

I.3 Details of Master students

I.3.1 Entry criteria

Enumerate by ticking all possible, appropriate entry criteria for admission to the Consecutive Master

	Please, give your answers for each of the four categories of students	Home	EU (27)	Other European countries	Others
I.3.1.1	directly after the first degree				
I.3.1.2	after admission examination				
I.3.1.3	after the completion of an intermediate degree				
I.3.1.4	trough a transfer when is a lower degree				
I.3.1.5	other/please, specify				

I.3.2 Number of places

I.3.2.1 Available places (answer by ticking)

Are the places available for master studies limited by:

I.3.2.1.1	national regulations	
I.3.2.1.2	university regulations	
I.3.2.1.3	department/faculty regulations	
I.3.2.1.4	financial and other resources	

I.3.3.2 The filling of available places

	Please, indicate by YES or No which of the following criteria must be satisfied for admission to a Consecutive Master programme for each of the two categories of students	YES/NO
I.3.2.2.1	For students with a foreign qualification, is a recognition procedure needed?	
I.3.2.2.2	For a home student, is a satisfactory performance in a competitive examination needed?	

I.4 Research work (in case of Taught &Research Master programmes)

I.4.1	Must the subject of the research be an active research area in the department?	YES/NO
I.4.2	The theme of the research is normally assigned	
I.4.2.1	- at the beginning of the programme	
I.4.2.2	- after a specified period of course work	
I.4.2.3	- other. Please, specify	
I.4.3	Many students perform research work outside the institution	YES/NO
I.4.3.1	What is the percentage of students for which the location of the research work is outside the institution	%
I.4.4	If the total workload corresponding to the Master degree corresponds to 100 units, what is the number of units corresponding to the research work?	
I.4.4.1	- less than 30	
I.4.4.2	- between 30 and 50	
I.4.4.3	- more than 50	

I.5 Statistics on recent master students (figures based on last 3 academic years)

I.5.1	What is the average number of master students graduating per year	
I.5.2	What is the average ratio between the number of master students graduating per year and the number of first cycle degree (Bachelor) students graduating per year	
I.5.3	What is the typical age of students obtaining the master degree?	
I.5.4	What id the percentage of female master graduates	%
I.5.5	What percentage of the master graduates are from the home country?	%

Part II. Master plus programmes

II.1 Information on the programmes

II.1.1	Name of the qualification (title, degree) awarded	
	- in original language	
	- in English	
II.1.2	Nominal (legal) duration in years	
II.1.3	Total ECTS credits required (if applicable)	
II.1.4	How many Master plus programmes are offered by your Faculty/Department:	
II.1.5	Names of the Master plus programmes offered:	
II.1.5.1	- in original language	
	- in English	
II.1.5.2	- in original language	
	- in English	

II.2 Two sample curricula for Master Plus programmes

A. Name of the Master plus programmes

Crt. No.	Name of course unit (in English)	Year of study	Type C/E/F *	Contact hours					ECTS credits
				Total contact hours	From which spent on **				
					L	CL	LAB	P	

*** C = Compulsory; E=elective; F=facultative**
**** L - lectures; CL – class work; LAB – laboratory work; P – project;**

B. Name of the Master plus programmes

Crt. No.	Name of course unit (in English)	Year of study	Type C/E/F *	Contact hours					ECTS credits
				Total contact hours	From which spent on **				
					L	CL	LAB	P	

*** C = Compulsory; E=elective; F=facultative**
**** L - lectures; CL – class work; LAB – laboratory work; P – project;**

II.3 Details of Master students

II.3.1 Entry criteria

Enumerate by ticking all possible, appropriate entry criteria for admission to the Master plus programme

	Please, give your answers for each of the four categories of students	Home	EU (27)	Other European countries	Others
II.3.1.1	directly after the first degree				
II.3.1.2	after admission examination				
II.3.1.3	after the completion of an intermediate degree				
II.3.1.4	trough a transfer when is a lower degree				
II.3.1.5	other/please, specify				

II.3.2 Number of places

II.3.2.1 Available places (answer by ticking)

Are the places available for master studies limited by:

II.3.2.1.1	national regulations	
II.3.2.1.2	university regulations	
II.3.2.1.3	department/faculty regulations	
II.3.2.1.4	financial and other resources	

II.3.3.2 The filling of available places

	Please, indicate by YES or No which of the following criteria must be satisfied for admission to a Consecutive Master programme for each of the two categories of students	YES/NO
II.3.2.2.1	For students with a foreign qualification, is a recognition procedure needed?	
II.3.2.2.2	For a home student, is a satisfactory performance in a competitive examination needed?	

II.4 Research work (in case of Taught & Research Master Plus programmes)

II.4.1	Must the subject of the research be an active research area in the department?	YES/NO
II.4.2	The theme of the research is normally assigned	
II.4.2.1	- at the beginning of the programme	
II.4.2.2	- after a specified period of course work	
II.4.2.3	- other. Please, specify	
II.4.3	Many students perform research work outside the institution	YES/NO
II.4.3.1	What is the percentage of students for which the location of the research work is outside the institution	%
II.4.4	If the total workload corresponding to the Master degree corresponds to 100 units, what is the number of units corresponding to the research work?	
II.4.4.1	- less than 30	
II.4.4.2	- between 30 and 50	
II.4.4.3	- more than 50	

II.5 Statistics on recent master students (figures based on last 3 academic years)

II.5.1	What is the average number of master students graduating per year	
II.5.2	What is the average ratio between the number of master students graduating per year and the number of first cycle degree (Bachelor) students graduating per year	
II.5.3	What is the typical age of students obtaining the master degree?	
II.5.4	What id the percentage of female master graduates	%
II.5.5	What percentage of the master graduates are from the home country?	%

Sample curricula
EUCEET survey on Master programmes

A) CONSECUTIVE MASTER PROGRAMME

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Catholic University Leuven			*Master in engineering science:* ***Civil engineering***					
Structural dynamics	1	C	60	34	26			6
Design of concrete structures	1	C	62	32	30			6
Building materials	1	C	28	18	10			3
Finite elements	1	C	58	35	23			6
The art of building	1	C	22.5	22.5				3
Foundation technology	1	C	51	40	11			6
Open channel flow	1	C	49	15	34			4
Sanitary engineering	1	C	32	15	17			3
Water distribution	1	C	52				52	3
River engineering	1	C	56.5	22.5	34			5
Roads, bridges, tunnels	1	C	90	45			45	9
Building law	2	C	19.5	19.5				3
Environment and sustainable development	2	C	20	20				3
Project management	2	C	24	24				3
Coastal engineering	2	C	31	10	21			
Steel structures	2	C	52				52	3
Hydraulic structures	2	C	20	20				3
Industrial buildings	2	C	22.5	22.5				3
Flexible structures	2	C	45				45	
Many electives	1 and 2	E						
Master thesis	2	C	720					24
Catholic University Leuven			*Master in engineering science:* ***Geotechnical and Mining engineering***					
Intellectual property rights	1	C	19.5	19.5				3
Technical English or French	1	C	39	39				3
Numerical discretisation methods	1	C	60	33	27			6

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Electrical energy	1	C	25	20		5		3
Machine construction	1	C	28	20	8			3
Soil mechanics	1	C	56	36	20			6
Mineralogy	1	C	51	30		21		6
Geology/petrology	1	C	69.5	23.5		46		5
Ores	1	C	41.5	19.5		22.5		4
hydrogeology	1	C	53.5	32.5	21			5
Mining methods	1	C	39.5	22.5	17			4
Geostatistics	1	C	43	20	23			4
GIS	1	C	32	15	17			3
Geophyiscs	1	C	100	50	50			10
Digital signal processing	1	C	35.5	18	17.5			4
Projects	1 & 2	C	100				100	6
Master thesis	2	C	720					24
Energy	2	C	19.5	19.5				3
Rock mechanics	2	C	20	20				3
Petrol engineering	2	C	20	20				3
Foundation techniques	2	C	51	40	11			6
Many electives	2	E						
VSB – Technical University of Ostrava			*Master in **Geotechnics** (1,5 years)*					
Mechanics of Underground Structures	1	C	4	2	2			5
Finite Element Method	1	C	4	2	2			5
Geohydrodynamics	1	C	4	2	2			5
Driving of Underground Openings and Shifting	1	C	4	2	2			4
Ventilation of Underground Structures	1	C	4	2	2			4
Blasting Works and Their Impacts	1	C	5	2	3			4
Modeling in Geotechnics	1	C	2	0	2			3
Underground Engineering	1	C	4	2	2			6
Geotechnical construction	1	C	4	2	2			5
Road and Geotechnical Laboratory	1	C	3			3		3
Statics and Dynamics of Geotechnical Structures	1	C	5	3	2			6

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Metal and Timber Structures	1	C	4	2	2			5
Concrete Structures	1	C	4	2	2			5
Organization and Management of Construction Work	2	C	4	2	2			5
Building Law and EU law	2	C	4	2	2			5
Environmental impact assessment	2	C	4	2	2			5
Structure Quality Control and Diagnostics of Objecte	2	C	4	2	2			5
Diploma Project	2	C	10				10	10
VSB – Technical University of Ostrava			*Master in **Municipal Engineering and Town Planning** (1,5 years)*					
Numerical Methods and Statistics	1	C	4	2	2			4
Mathematical Modelling	1	C	4	2	2			5
Regional Architecture	1	C	4	2	2			5
Typology of Buildings	1	C	4	2	2			5
Regional Planning	1	C	4	2	2			5
Municipal Engineering	1	C	4	2	2			4
Project II	1	C	2				2	2
Concrete Structures	1	C	4	2	2			5
Metal and Timber Structures	1	C	4	2	2			5
Urban Planning	1	C	4	2	2			5
Brownfields Regeneration	1	C	4	2	2			5
Investment Processes	1	C	4	2	2			4
Urban demography and sociology	1	C	4	2	2			4
Project II	1	C	2				2	2
Organization and Management of Construction Work	2	C	4	2	2			5
Building Law and Law of EU	2	C	4	2	2			5
Environmental impact assessment	2	C	4	2	2			5

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Structure Quality Control and Diagnostics of Objecte	2	C	4	2	2			5
Diploma Project	2	C	10				10	10
VSB – Technical University of Ostrava			*Master in **Building Constructions** (1,5 years)*					
Numerical Methods and Statistics	1		4	2	2			4
Finite Element Method	1		4	2	2			5
Elasticity and Plasticity	1		4	2	2			5
I.Structures of Building Constructions I.	1		4	2	2			5
Structural Dynamics	1		4	2	2			5
Transportation Structures	1		4	2	2			4
Project I	1		2				2	2
Concrete Structures	1		4	2	2			5
Metal and Timber Structures	1		4	2	2			5
Konstrukce pozemních staveb II.	1		4	2	2			5
Underground and Geotechnical Constructions	1		4	2	2			5
Waterworks Construction	1		4	2	2			4
Building Technologies	1		4	2	2			4
ProjectII	1		2				2	2
Organization and Management of Construction Work	2		4	2	2			5
Building Law of EU	2		4	2	2			5
Environmental impact assessment	2		4	2	2			5
Structure Quality Control and Diagnostics of Objecte	2		4	2	2			5
Diploma Project	2		10				10	10

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
CTU in Prague			*Consecutive Master in **Building Structures***					
Mathematics 4	1/W	C	4	2	2			5
Material Engineering	1/W	C	4	2		2		4
Building Structures 6C	1/W	C	4	2			2	4
Numerical Analysis	1/W	C	3	2	1			4
Concrete Structures 4C	1/W	C	3	2	1			3
Steel Structures 3C	1/W	C	3	2	1			3
Project 3C	1/W	C	4				4	5
Elective course	1/W	E	2	1	1			2
Experimental Structure Analysis	1/S	C	3	1	2			4
Dynamics of Building Structures	1/S	C	3	1	1			4
Concrete Structure 5C	1/S	C	3	2	1			4
Timber Structures 2	1/S	C	3	2	1			3
Buildings Foundation 2	1/S	C	4	2	2			4
Project	1/S	C	4				4	5
Elective Courses	1/S	E	6	3	3			6
Final Project	2	C	24				24	30
CTU in Prague			*Consecutive Master in **Water Management and Water Structures***					
Applied Hydrology	1/W	C	3	2	1			4
Hydraulics 3	1/W	C	4	2	1	1		5
Water Resources Systems	1/W	C	3	2	1			4
Operation and Security of Water Constructions	1/W	C	3	2	1			4
Hydraulics of Underground Water	1/W	C	4	2	2			5
Elective courses	1/W	E	6		2	2	2	8
Structure and Technology in Hydrotechnics	1/S	C	3	2	1			4
Stochastic Processes in Water Management	1/S	C	2	1	1			2
Water Pollution	1/S	C	4	2		2		5
Drainage of urbanized Watersheds	1/S	C	4	2	2			5
Water Management of	1/S	C	4	2	2			5

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Urban Areas								
Diploma Seminar	1/S	C	2				2	2
Elective Courses	1/S	E	6		2	2	2	7
Final Project	2	C	24				24	30
CTU in Prague			*Consecutive Master in **Structural and Transportation Engineering***					
Mathematics 4	1/W	C	4	2	2			5
Numerical Analysis of Structures	1/W	C	3	2	1			4
Dynamics of Building Structures	1/W	C	3	2	1			4
Geotechnics	1/W	C	4	2	1	1		5
Elective courses	1/W	E	10		4	2	4	12
Experimental Analysis of Structures	1/S	C	3	1		2		4
Elective courses	1/S	E	17	11	2		4	22
Diploma Seminar	1/S	C	4				4	4
Final Project	2	C	24				24	30
Budapest University of Technology and Economics			*Consecutive Master in **Structural Engineering, Major of Structural and Geotechnical Engineering***					
Mathematics in Civil Eng. MSc	1	C	3	2	1			3
Numerical methods	1	C	3	1	2			4
Databese Systems	1	C	2	2				2
Mechanics MSc	1	C	3	2	1			4
Mathematical Bases of FEM	1	C	2	2				2
Building Physics and Chemics	1	C	2	2				2
Knowledge of EU	2	C	2	2				2
English Communication	1	C	2		2			2
Engineering Ethics	2	C	2	2				2
Decision Supporting Methods	2	C	2	2				2
Theory of Design	1	C	2	2				2
Building Structures MSc	1	C	2	2				2
Building Materials MSc	1	C	2	2				2
Interaction of Soil and Structures	1	C	2	2				2
Geotechnical Design	1	C	3	2	2			4
Theory of Stability	1	C	3	2	1			3
Dynamics of Structures	1	C	2	2				3

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Surface Structures	1	C	2	1	1			2
Shell Structures	1	E	2	1	1			3
Spatial Structures	1	E	2	2				3
Seismical Design	1	E	2	1	1			3
Strengthening of Stuctures	1	E	2	1	1			3
Numerical Methods in Geotechnics	1	E	2	1	1			3
Geotechnical Case Studies	1	E	2	2				3
Prestressed Structures	1	E	2	1	1			2
Thin-walled Structures	1	E	2	1	1			2
FEM of Steel Structiures	1	E	2	1	1			2
Structural CAD	1	E	2	1	1			2
Experimental Structure Analysis	1	E	2	1		1		2
Fatigue, Brittle Fracture	1	E	2	2				2
Facultative Subjects	2	F						5
Diploma Project	2	C					15	20
Budapest University of Technology and Economics			*Consecutive Master in* ***Infrastructural Engineering, Major of Highway and Railway Engineering***					
Mathematics in Civil Eng. MSc	1	C	3	2	1			3
Numerical methods	1	C	3	1	2			4
Databese Systems	1	C	2	2				2
Engineering Ecology	1	C	3	3				3
Hydromorphology	1	C	3	2	1			3
Modelling of Environmental systems	1	C	2	2				2
Knowledge of EU	2	C	2	2				2
English Communication	1	C	2		2			2
Engineering Ethics	2	C	2	2				2
Environmental Economics	2	C	2	2				2
Earth Work of Infrastructures	1	C	3	2	1			4
Structures for the Infrastructures	1	C	3	2	1			4
Highway Design MSc	1	C	3	2	1			4
Railway Design MSc	1	C	3	2	1			4

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Environmental Monitoring	1	C	2	2				2
Road Network Modelling	1	C	2	1	1			2
Design of Complex Systems	1	E	5	1	4			6
Intelligent transportation Systems	1	E	3	1	2			4
Road Pavement Structures and Construction	1	E	3	2	1			3
Railroad Track Structures	1	E	3	2	1			3
Road Operation and Maintenance	1	E	2	2				3
Railroad Operation and Maintenance	1	E	2	2				3
High Speed Trains	1	E	2	2				3
Informatics of Transportation Systems	1	E	3	1		2		3
Cable Traks	1	E	2	2				2
Facultative Subjects	2	F						5
Diploma Project	2	C					15	20
Budapest University of Technology and Economics			*Consecutive Master:* ***Surveying and Geoinformatical Engineering, Major of Geoinformatics***					
Mathematics in Civil Eng. MSc	1	C	3	2	1			3
Numerical methods	1	C	3	1	2			4
Databese Systems	1	C	2	2				2
Informatics MSc	1	C	3	2	1			4
Adjusment Calculation MSc	1	C	2	1	1			2
Geophysics	1	C	2	2				2
Knowledge of EU	2	C	2	2				2
English Communication	1	C	2		2			2
Engineering Ethics	2	C	2	2				2
Geoinformatical Management	2	C	2	2				2
Spatial Data Collection	1	C	4	2	2			4
Geoinformatics MSc	1	C	2	1				4
Topography	1	C	3	2	1			4
Geoinformatical Systems	1	C	3	2	1			4

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Intelligent transportation Systems	1	C	3	1	2			4
Complex Geoinformatical Course	1	E	4			4		4
Photogrammetry MSc	1	E	2	1	1			3
Geoinformatical Dta Bases	1	E	2	1	1			3
Geoinformatical Modelling	1	E	3	2	1			3
Integrated Measuring Systems	1	E	3	2	1			3
Geoinformatics in Business	1	E	2	2				3
Environmental Geoinformatical Systems	1	E	3	2	1			3
IT Tools	1	E	3	2	1			3
Computer Graphycs	1	E	2	1	1			3
Cartography	1	E	2	1	1			2
Facultative Subjects	2	F						5
Diploma Project	2	C					15	20
University College Dublin			*Consecutive Master in:* ***Master of Engineering (Structural Engineering with Architecture)***					
Professional Engineering for Civil/Structural Engineers	1	C	120	36	72	12 *		5
Structural Design and Analysis I	1	C	110	30	70	10 *		5
Structural Design and Analysis II	1	C	108	36	72			5
Soil Mechanics and Systems	1	C	120	36	68	16 (lab)		5
Bridge Engineering	1	C	110	36	72	2 (lab)		5
Professional Studies I	1	E	100	12	42	12 * 34**		5
8-month Work Placement	1	C	525 - 600				525 – 600	30
Structural Engineering and Design III	2	C	108	36	72			5

* (tutorial)
** (assignments)

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Materials and Design	2	C	120	36	74	10 (lab)		5
Case Studies	2	C	100	30	40	30 **		5
Planning Methodology	2	C	100	20	80			5
Construction Management	2	C	123	36	75	12 **		5
Research and Innovation in the Designed Environment	2	E	115	10	90	15 ***		5
Soil Mechanics and Geotechnical Engineering	2	C	112	36	64	6 (lab) 6 *		5
Research Project	2	C	420				420	20
Professional Engineering (Management)	2	C	103	36	54	3 *** 10 **		5
University College Dublin			*Consecutive Master in:* ***Master of Engineering (Structural Engineering with Architecture***					
Same curriculum for Option A above EXCEPT Replace CVEN40130 (Work Placement) with the following:								
Stage 1 Project	1	C	400				400	20
Design Technologies II	1	C	122	12	60	32 (practicals) 18 **		5
Computational Continuum Mechanics	1	C	110	30	70	10 *		5
Trinity College Dublin			*Consecutive Master in* ***Civil Engineering***					
A1. Civil Engineering Management	1	C		Y	Y		Y	15
A2. Dissertation Phase 1	1	C		Y	Y		Y	15
A3. Dissertation Phase 2	1	C			Y	Y	Y	30
B1. Ground Engineering	1	E		Y	Y			5

* (tutorial)
** (assignments)
*** (seminar)

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
B3. Introduction to Transportation Engineering		E		Y	Y			5
B4. Engineering Hydrology	1	E		Y	Y			5
B5. Introduction to Environmental Analysis	1	E		Y	Y			5
B6. Environmental Engineering	1	E		Y	Y			5
B7. Transport Modelling	1	E		Y	Y			5
C1. Highway Engineering	1	E		Y	Y			5
C2. Applied Transportation Analysis	1	E		Y	Y			5
C3. Bridge Engineering	1	E		Y	Y			5
C4. Renewable Energy	1	E		Y	Y			5
C5. Waste and Environmental Management	1	E		Y	Y			5
C6. Water Quality and Hydrological Modelling	1	E		Y	Y			5
C7. Water Resource Planning	1	E		Y	Y			5
C8. Modelling of Civil Engineering Systems	1	E		Y	Y			5
Politecnico di Milano			*Consecutive Master in* ***Master of Science in Civil Engineering – Structural Engineering Program***					
Surveying and adjustment theory	1	C	48	32	16			5
Theory of Structures	1	C	48	32	16			5
Computational mechanics and inelastic structural analysis	1	C	114	54	44	16		10
Structural analysis and design 2 (for Civil Engineering)	1	C	48	32	16			5
Dynamics of structures 1	1	C	48	32	16			5
Numerical methods in engineering (civil engineering)	1	C	56	32		24		5

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Stability of structures 1	1	C	48	32	16			5
Reinforced and prestressed concrete structures	1	E	96	64	32			10
Computer methods in structural analysis 1	1	E	48	32	16			5
Durabilty of materials and repair technologies of structures	1	E	54	36	10	8		5
Seismic engineering analysis and design	2	E	96	64	32			10
Mechanics of materials and inelastic constitutive laws	2	E	48	32	16			5
Precast concrete structures 1	2	E	48	32	16			5
Foundations and retaining structures	2	E	96	64	32			10
Steel structures	2	E	96	64	32			10
Bridges construction 1	2	E	96	32	16			5
Politecnico di Milano			*Consecutive Master in* ***Master of Science in Civil Engineering – Geotechnical Engineering Program***					
Surveying and adjustment theory	1	C	48	32	16			5
Theory of Structures	1	C	48	32	16			5
Computational mechanics and inelastic structural analysis	1	C	114	54	44	16		10
Structural analysis and design 2 (for Civil Engineering)	1	C	48	32	16			5
Dynamics of structures 1	1	C	48	32	16			5
Numerical methods in engineering (civil engineering)	1	C	56	32		24		5
Environmental geomechanics	1	C	48	32	16			5
Reinforced and prestressed concrete structures	1	C	48	32	16			5

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
1								
Seismic risk of territory	1	E	48	32	16			5
Applied geophysics	1	E	48	32	16	8		5
Soil remediation	1	E	48	32	16			5
Foundations and retaining structures	2	C	96	64	32			10
Engineering geology	2	C	48	32	16			5
Underground structures	2	C	48	32	16			5
Geotecnics applied to land protection	2	C	96	64	32			10
Mechanics of materials and inelastic constitutive laws	2	E	48	32	16			5
Computer methods in structural analysis 1	2	E	48	32	16			5
Fracture mechanics	2	E	48	32	16			5
Politecnico di Milano			*Consecutive Master in* ***Master of Science in Civil Engineering – Hydraulic Engineering Program***					
Numerical analysis	1	C	56	32		24		5
Hydrology	1	C	54	30	16	8		5
Maritime hydrodynamics	1	C	96	64	32			10
Treatment plants of water supply 1	1	E	48	32	16			5
Structural analysis and design 2	1	E	48	32	16			5
Hydraulics 2 (A+B)	1	C	104	64	16	24		10
River catchments management	1	C	96	64	32			10
Groundwater	1	E	48	32	16			5
Environmental thermodynamics and heat B	1	E	48	32	16			5
Hydraulic engineering 2	2	C	52	34	6		12	5
Hydraulic plants	2	C	112	58	30		24	10
Geotecnics applied to land protection 1	2	E	48	32	16			5
Soil remediation	2	E	48	32	16			5
Bridges construction 1	2	E	96	32	16			5

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Wastewater treatments 1	2	E	48	32	16			5
Numerical methods for environmental fluid dynamics	2	E	56	32		24		5
Treatment plants of water supply 1	2	E	47	32	15			5
University of Pisa			*Consecutive Master in* ***Hydraulics, Transportations and Territory Engineering (Curriculum Hydraulics)***					
Hydraulic Constructions	1	C	120	80	40			12
Stability of natural and artificial slopes	1	C	60	40	20			6
Territorial Engineering and Planning I	1	C	60	40		20		6
Structural Engineering	1	C	120	80			40	12
Road infrastructures	1	C	90	60	30			9
Land survey methods in topography	1	C	60	40	20			6
Hydraulics and marine constructions	2	C	90	60	30			9
Hydrology	2	C	90	60	30			9
Hydrodinamics	2	C	90	60	30			9
Sanitary & Environmental Engineering	2	C	90	60	30			9
Hydraulic protection of the environment	2	C	90	60	30			9
Subject selected by the student	1							9
Thesis	2							15
University of Pisa			*Consecutive Master in* ***Hydraulics, Transportations and Territory Engineering (Curriculum Transportations)***					
Hydraulic Constructions	1	C	120	80	40			12
Stability of natural and artificial slopes	1	C	60	40	20			6
Territorial Engineering and Planning I	1	C	60	40		20		6
Structural Engineering	1	C	120	80			40	12

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Road infrastructures	1	C	90	60	30			9
Land survey methods in topography	1	C	60	40	20			6
Road, Railways, Airports	2	C	90	60	30			9
Transportation techniques and economics	2	C	90	60	30			9
Traffic engineering	2	C	90	60	30			9
Transportation Planning	2	C	90	60	30			9
Safety criterion in road Constructions	2	C	90	60	30			9
Subject selected by the student	1							9
Thesis	2							15
University of Pisa			*Consecutive Master in* ***Hydraulics, Transportations and Territory Engineering (Curriculum Territory Engineering)***					
Hydraulic Constructions	1	C	120	80	40			12
Stability of natural and artificial slopes	1	C	60	40	20			6
Territorial Engineering and Planning I	1	C	60	40		20		6
Structural Engineering	1	C	120	80			40	12
Road infrastructures	1	C	90	60	30			9
Land survey methods in topography	1	C	60	40	20			6
Geophysical & Geotechnical Investigations	2	C	90	60	30			9
Territorial Engineering and Planning II	2	C	90	60	30			9
Hydraulic protection of the environment	2	C	90	60	30			9
Transportation Planning	2	C	90	60	30			9
Environmental Chemistrys	2	C	90	60	30			9
Subject selected by the student	1							9
Thesis	2							15

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Vilnius Gediminas Technical University			*Consecutive Master in* ***Construction Engineering*** *(specizlization - Architecture Engineering)*					
Phylosophy of Art	1	C	64					6,00
Scientific Research Fundamentals	1	C	48					4,50
Research Work 1	1	C	-					4,50
Theory and Methods of Optimization in Technics	1	C	80					7,50
Architectural Aided Design	1	E	80					7,50
Modern Steel and Composite Structures	1	E	80					7,50
Protection of Architecture Heritage	1	C	48					4,50
Research Work 2	1	C	-					6,00
Structural analysis and computer-aided simulation	1	C	80					7,50
Computer Aided Analysis of Structures	1	C	80					7,50
History of Architectural Theory	1	E	48					4,50
Tectonics of Architecture	1	C	48					4,50
Constructions' Exploratory Methods	1	C	48					4,50
Management of Building Design and Construction	1	E	48					4,50
Culturology of City	2	C	48					4,50
The Historic Research of the Buildings	2	C	64					6,00
Consolidation of Building Constructions	2	C	64					6,00
Research Work 3	2	C	-					7,50
Nonlinear Analysis of Structures	2	E	64					6,00
Management Psychology	2	E	64					6,00
Master's Thesis	2	C	-					30,00

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Vilnius Gediminas Technical University			*Consecutive Master in **Construction Management** (Specialization - Construction Technology and Management)*					
Scientific Research Fundamentals	1	C	48					4,50
Computer Aided Design	1	C	80					7,50
Theory and Methods of Optimization in Technics	1	C	80					7,50
Research Work 1	1	C	-					4,50
Quality Management Systems	1	E	64					6,00
Methods of Operational Research	1	E	64					6,00
Quality Management Systems in Construction	1	C	80					7,50
Research Work 2	1	C	-					6,00
Modern Construction Technologies	1	C	48					4,50
Decision Support Systems in Construction	1	C	80					7,50
Fundamentals of Real Estate Appraisal	1	E	48					4,50
Finance Institutions and Finance Markets	1	E	48					4,50
Strategic Management	1	E	48					4,50
Electronic Business	2	C	48					4,50
Research Work 3	2	C	-					7,50
Business Planning and Management, Strategic Management	2	C	64					6,00
Construction Law	2	C	64					6,00
Economics of Building Industry and Investments	2	E	64					6,00
Safety Systems Management in Construction	2	E	64					6,00

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Master's Thesis	2	C	-					30,00
Vilnius Gediminas Technical University			*Consecutive Master in **Building Structures***					
Scientific Research Fundamentals	1	C	48					4,50
Computer Aided Design	1	C	80					7,50
Theory and Methods of Optimization in Technics	1	C	80					7,50
Research Work 1	1	C	-					4,50
System Analysis in Civil Engineering	1	E	64					6,00
Quality Management Systems	1	E	64					6,00
Computer Aided Design 2	1	C	64					6,00
Laminated Structures	1	C	80					7,50
Durability and Reliability of Structures	1	C	48					4,50
Mechanics of Continual Structures	1	C	64					6,00
Research Work 2	1	C	-					6,00
Soil Stress-Strain State	1	E	64					6,00
Mechanics of Continual Structures	1	E	64					6,00
Research Work 3	2	C	-					7,50
Special Reinforced Concrete Structures	2	E	96					9,00
Special Steel and Timber Buildings	2	E	96					9,00
Reconstruction and Repair of Masonry and Reinforced Concrete Construction Works	2	E	48					4,50
Composite Steel Structures and Buildings	2	E	48					4,50
Influence of Preserve Actions on Reinforced Concrete	2	E	48					4,50

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Structures								
Non-Linear Mechanics of Reinforced Concrete	2	E	48					4,50
Protection of Steel and Timber Structures from Ambient Factors	2	E	48					4,50
Nonlinear Analysis and Design of Steel Structures	2	E	48					4,50
Master'sThesis	2	C	-					30,00
Riga Technical University			*Consecutive Master in* ***Professional Master in Civil Engineering***					
Experimental verifications of constructive building elements	1	C	64	32		32		3
Finite elements method	1	C	64	64				6
Reinforcement of building structures	1	C	64	32		32		3
Buildings' reconstruction and restoration	1	E	2	1	1			3
Practical construction physics	1	E	32	16	16			3
Construction acoustics basis	1	E	32	16	16			3
Building machines, special course	1	E	32	16	16			3
Sanitary engineering assembling technology	1	E	32	16	16			3
Special course on building structures automatized designing	1	E	64	32	32			6
Protection of structures	1	E	32	16	16			3
Supplementary course on architecture designing	1	E	64	32	32			6
Individual construction	1	E	32	16	16			3
Survey and verification of structures	1	E	32	16	16			3

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Metal constructions, special course	1	E	32	16	16			3
Wooden and plastic constructions, special course	1	E	48	16	16	16		4,5
Reinforced concrete constructions, special course	1	E	48	16	16	16		4,5
Special course on building structures automatized design	1	E	64	32	32			6
Computerized design	1	E	32			32		3
Metrology, examination and verification of constructions	1	E	32	16		16		3
Interactive computer graphics	1	E	32			32		3
Reinforcement of building constructions	1	E	48	32		16		4,5
Methods of material testing	1	E	48	32		16		3
New building materials	1	E	48	32		16		3
Assessment of structures	1	E	32	16	16			3
Environment protection in construction	1	E	32	32				3
Survey of structures	1	E	32	32				3
Technological design	1	E	64	32	32			6
Formation of prices in construction	1	E	48	32	16			4,5
Construction economy	1	E	32	32				3
Marketing in construction	1	E	32	32				3
Management in construction	1	E	32	32				3
Pedagogy	1	E	32	32				3
Psychology	1	E	32	32				3
Practical placement	1	E	96	In comp anies	9			
Master thesis	1	E	320				320	30

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Riga Technical University			*Consecutive Master in* ***Professional Master in Transportation Engineering***					
Finite element methods	1	C	64	32		32		6
Modern building materials	1	C	64	32		32		6
Road traffic planning and safety	1	E	64	32		32		6
Introduction of traffic flow theory	1	E	64	64				6
Aesthetics of transport structure	1	E	32	32				3
Well-fitting of roads	1	E	32	32				3
Building materials in road construction	1	E	32	32				3
Construction materials for special buildings	1	E	32	32				3
Railroads in ports	1	E	32	32				3
Pedagogy	1	E	32	32				3
Psychology	1	E	32	32				3
Practical placement	1	E	96	In comp anies	9			
Master thesis	1	E	320				320	30
Bialystok Technical University			*Consecutive Master in* ***Road Engineering***					
Mathematics Metods in CE	1	C	60	30	30			5
Technology of road materials	1	C	60	30		30		5
Design of roads and streets	1	C	60	30			30	5
Organization and safety of traffic	1	C	60	30			30	5
Complex Concrete Structures	1	E/F	30	15			15	2
Theory of Elasticity and Plasticity	1	C	60	30	30			4
Underground Building Structures	1	C	60	30			30	4
Exploitation and management of roads	1	C	60	30			30	5
Technology of road pavements	1	C	60	30		30		5

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Organization and economics of road works	1	C	45	15	30			3
Road pavement structures	1	C	60	30			30	5
Road crossings	1	C	60	30			30	5
Environmental protection	1	C	30	30				2
Bridges	1	C	45	15			30	3
Complex metallic structures	1	E/F	30	15			15	2
Informatics Methods in Road Design	2	C	45	15	30			3
Management of constructional works	2	C	45	45				3
Diploma seminar	2	C	30		30			4
Diploma work	2							20
Bialystok Technical University			*Consecutive Master in* ***Building and Engineering Structures***					
Mathematics Metods in CE	1	C	60	30	30			5
Metallic structures Made of bent profiles	1	C	60	30			30	5
Prestressed structures	1	C	75	30	15		30	5
Bases of industrial building	1	C	60	30			30	5
Special foundations	1	C	30	15			15	3
Theory of Elasticity and Plasticity	1	C	60	30	30			4
Underground Building Structures	1	C	60	30			30	3
Mechanics of Engineering Structures	1	C	90	45			45	7
Complex metallic structures	1	C	75	30			45	6
Concrete Engineering Structures	1	C	75	30			45	6
Municipal building	1	C	60	30			30	5
Concrete bridges	1	C	45	15			30	3
Steel bridges	1	C	45	15			30	3
Informatics methods	2	C	45	15	30			3
Management of constructional works	2	C	45	45				3

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Diploma seminar	2	C	30		30			4
Diploma work	2							20
Rzeszow University of Technology			*Consecutive Master in* ***Building and engineering structures***					
Foreign language for technology	1	C	60		60			2
Advanced mathematics	1	C	60	30	30			6
Theory of elasticity and plasticity	1	C	45	15	30			4
Computer methods	1	C	45	15		30		4
Advanced concrete structures	1	C	45	15			30	5
Advanced metal structures	1	C	45	15			30	4
Construction project engineering	2	C	30	15	15			2
Structural fire design	1	C	45	30			15	4
Computer aided design	1	C	45	15		30		4
Materials engineering	2	C	30	15		15		3
Economy law	2	C	15	15				2
Basis of structural design	1	C	45	30		15		4
Shaping of structures	1	C	45	30			15	4
Municipal constructions	1	C	60	30			30	5
Foundation II	1	C	60	30			30	5
Prestressed structures	1	C	60	30		15	15	6
Selected problems of concrete structures	2	C	75	45			30	6
Selected problems of metal structures	2	C	75	45			30	6
Timber structures	2	F	45	15		15	15	3
Masonry structures	2	F	45	15			30	3
Diploma seminar	2	C	30		30			2
Diploma thesis	2	C						20
Rzeszow University of Technology			*Consecutive Master in* ***Computer aided analysis of structures***					
Foreign language for technology	1	C	60		60			2
Advanced mathematics	1	C	60	30	30			6
Theory of elasticity and plasticity	1	C	45	15	30			4

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Computer methods	1	C	45	15		30		4
Advanced concrete structures	1	C	45	15			30	5
Advanced metal structures	1	C	45	15			30	4
Construction project engineering	2	C	30	15	15			2
Foreign language for technology	1	C	60		60			2
Advanced mathematics	1	C	60	30	30			6
Theory of elasticity and plasticity	1	C	45	15	30			4
Computer methods	1	C	45	15		30		4
Advanced concrete structures	1	C	45	15			30	5
Advanced metal structures	1	C	45	15			30	4
Construction project engineering	2	C	30	15	15			2
Subjects for "computer aided analysis of structures" specialization								
Structural fire design	1	C	45	30			15	4
Computer aided design	1	C	45	15		30		4
Materials engineering	2	C	30	15		15		3
Economy law	2	C	15	15				2
Computer modeling of structures (FEM)	1	C	105	60		45		6
Dynamics of structures	1	C	60	30			30	5
Reliability and safety of structures	2	C	60	30			30	5
Spatial structures	1	C	60	30			30	5
Selected problems of building structures	1	C	45	15			30	4
Theory of experiments and experimental research	2	C	45	15		30		4
Informatics in civil engineering	2	C	45	15		30		3
Energy-saving buildings	2	F	45	15		15	15	3
Industrial structures	2	F	45	15			30	3
Diploma seminar	2	C	30		30			2
Diploma thesis	2	C						20

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Rzeszow University of Technology			*Consecutive Master in* ***Bridge building and maintenance***					
Foreign language for technology	1	C	60		60			2
Advanced mathematics	1	C	60	30	30			6
Theory of elasticity and plasticity	1	C	45	15	30			4
Computer methods	1	C	45	15		30		4
Advanced concrete structures	1	C	45	15			30	5
Advanced metal structures	1	C	45	15			30	4
Construction project engineering	2	C	30	15	15			2
Road design and construction	1	C	45	30			15	4
Geotechnical engineering	1	C	30	15			15	3
Concrete bridges I	1	C	60	30			30	4
Metal bridges I	1	C	60	30			30	4
Bridge supports	1	C	45	15			30	4
Temporary bridges	1	C	45	15			30	4
Computer aided design of bridges	1	C	45	15			30	4
Dynamics of bridges	2	C	15	15				2
Concrete bridges II	1	C	30	15			15	4
Metal bridges II	2	C	30	15			15	4
Bridge maintenance	1, 2	C	90	60		15	15	9
Bridge construction technology	2	C	60	30			30	4
Advanced analysis of bridge structures	2	F	45	15		15	15	3
Industrial structures	2	F	45	15			30	3
Diploma seminar	2	C	30		30			2
Diploma thesis	2	C						20
Warsaw University of Technology			*Master plus programmes:* ***Building and Engineering Structures***					
Humanity Course 1	1	C	30	30				2
Humanity Course 2	1	C	15	15				1
Diploma Seminar	2	C	30		30			2
Dissertation	2	C	-					13

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Diploma Examination	2	C	-					5
Mathematics	1	C	75	30	45			5
Wooden Structures	1	C	30	15			15	2
Concrete Structures	1	C	45	15			30	4
Metal Structures	1	C	45	15			30	4
Theory of Elasticity and Plasticity	1	C	90	50	40			9
Engineering of Building Materials	1	C	45	15		15	15	3
Methodology of Design of Building Processes	1	C	45	15	15		15	3
Computer Methods in Engineering Design	1	C	45			45		3
Structural Mechanics	1	C	45	15	15		15	4
Reliability of Structures	1	C	30	15	15			2
Special Concrete Structures	1	C	60	30			30	5
Special Metal Structures	1	C	60	30			30	5
Fire Safety	1	C	30	15			15	2
Design of Structures with the Use of Computer Programs	2	C	45			45		2
Industrial Concrete Buildings	2	C	45	15			30	4
Industrial Metal Buildings	2	C	45	15			30	4
Elective Subject 1	1	E	30	15			15	2
Elective Subject 2	1	E	30	15			15	2
Elective Subject 3	1	E	30	15			15	2
Warsaw University of Technology			*Master plus programmes:* ***Communication Engineering***					
Humanity Course 1	1	C	30	30				2
Humanity Course 2	1	C	15	15				1
Diploma Seminar	2	C	30		30			2
Dissertation	2	C	-					13
Diploma Examination	2	C	-					5
Mathematics	1	C	75	30	45			5

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Theory of Elasticity and Plasticity	1	C	75	45	30			5
Railway Roads	1	C	45	15			30	4
Roads Technical Mechanisms	1	C	45	15	15		15	3
Roads and Streets	1	C	105	45			60	7
Mechanics of Road Surfaces with FEM	1	C	30	15		15		3
Investment Design in Com. Engng.	1	C	45	15			30	3
Computer Methods in Com. Engng.	1	C	45			45		3
Movement Engineering	1	C	45	15			30	4
Economics of Transport	1	C	45	30			15	4
Technology of Road Materials and Surfaces	1	C	45	15		30		4
Maintenance of Communication Infrastructure	1,2	C	60	30			30	3
High Speed Roads	1	C	60	30			30	5
Fire Safety of Roads	2	C	15	15				1
Design of Roads with the Use of Computer Programs	1,2	C	75			75		5
Bridge Structures	2	C	45	15			30	2
Elective Subject 1	1	E	30	15			15	2
Elective Subject 2	1	E	30	15			15	2
Warsaw University of Technology			*Master plus programmes:* ***Building Production Engineering***					
Humanity Course 1	1	C	30	30				2
Humanity Course 2	1	C	15	15				1
Diploma Seminar	2	C	30		30			2
Dissertation	2	C	-					13
Diploma Examination	2	C	-					5
Mathematics	1	C	75	30	45			5
Theory of Elasticity and Plasticity	1	C	75	45	30			5
Methodology of Building Processes Design	1	C	30	15	15			2
Technology of Special Works	1	C	30	15			15	3
Engineering of Building Materials	1	C	30	15		15		3

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Building Physics	1	C	15	15				1
Metal Structures	1	C	60	30			30	5
Engineering of Production Processes	1	C	60	30			30	4
Structural Mechanics	1	C	45	15	15		15	5
Computer Methods in Building Production Engrg.	1	C	45			45		4
Repairing and Disassembly Works	1	C	30	15	15			2
Organization and Control of Building Process	1	C	30	15			15	2
Design and Working of Production Subsid.	1	C	45	15			30	4
Management of Quality, Safety and Environment	1	C	30	15	15			2
Technology of Building Composites	1	C	30	15		15		2
Concrete Structures	2	C	45	15			30	3
Fire Safety	1	C	15	15				1
Methods of Making Decisions	2	C	45	15	15		15	3
Technology of Special Concrete	1	C	15	15		30		4
Technology of Surfaces	1	C	60	30		30		3
Elective Subject 1	2	E	30	15			15	2
Elective Subject 2	2	E	30	15			15	2
Elective Subject 3	2	E	30	15			15	2
University of Beira Interior			*Consecutive Master in* ***Structures and Construction***					
Matrix Analysis of Structures	1	C	64	48	16			6
Advanced Reinforced Concrete	1	C	64	32	32			6
Steel Structures	1	C	64	48	16			6
Hydrology and Water Resources	1	C	64	32	32			6
Advanced Soil Mechanics	1	C	64	32	32			6
Prestressed Concrete	1	C	64	48	16			6
Dynamics and Seismic Engineering	1	C	64	32	32			6

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Building Physics	1	C	64	32	32			6
Foundations	1	C	64	32	32			6
Construction Pathology	1	C	64	32	32			6
Evaluation of Building Quality	2	E	64	48	16			6
Durability of Construction Materials	2	E	64	42	22			6
Special Structures	2	E	64	48	16			6
Plates and Shells	2	E	64	48	16			6
Special Concrete Technology	2	E	64	64				6
Structures Rehabilitation	2	E	64	32	32			6
Seminar on Structures	2	E	64	32	32			6
Technology of Construction Systems	2	E	64	32	32			6
Thesis	2	C	70	70				42
University of Beira Interior			*Consecutive Master in* ***Geotecnics and Environment***					
Matrix Analysis of Structures	1	C	64	48	16			6
Advanced Reinforced Concrete	1	C	64	32	32			6
Steel Structures	1	C	64	48	16			6
Hydrology and Water Resources	1	C	64	32	32			6
Advanced Soil Mechanics	1	C	64	32	32			6
Building Physics	1	C	64	32	32			6
Foundations	1	C	64	32	32			6
Environmental geotecnics 1	1	C	64	32	32			6
River Hydraulics	1	C	64	48	16			6
Environmental infrastructure	1	C	64	62	2			6
Environment and Planning	2	E	64	64				6
Environmental geotecnics 2	2	E	64	32	32			6
Environmental Impacts	2	E	64	32	32			6
Rock mechanics	2	E	64	32	32			6
Earth works	2	E	64	32	32			6
Thesis	2	C	70	70				42
Chalmers University of Technology			*Consecutive Master in* ***Geo and Water Engineering***					
Modelling and	1	C	70-84					7,5

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
problem solving in Civil Engineering								
Engineering geology	1	C	70-84					7,5
Environmetal analysis of water	1	C	70-84					7,5
Drinking water engineering	1	C	70-84					7,5
Geographjc information systems	!	E	70-84					7,5
Traffic and urban planning	1	E	70-84					7,5
Water waves mechanics	1	E	70-84					7,5
Geotechnics	1	E	70-84					7,5
Environmental management	1	E	70-84					7,5
Environmental risk assessment in engineering	1	E	70-84					7,5
Waste water engineering	2	E	70-84					7,5
Environmetnal analysis of water	2	E	70-84					7,5
Assessing sustainability assignements	2	E	70-84					7,5
Road engineering	2	E	70-84					7,5
Advanced analysis of aquatic system assessment	2	E	70-84					7,5
Risk based remediation	2	E	70-84					7,5
Master's Thesis	2	C						30 or 60
Chalmers University of Technology			*Consecutive Master in* ***Structural Engineering and Building Performance Design***					
Structural systems – design and assessment	1	C	70-84					7,5
Material performance	1	C	70-84					7,5
Finite element method - basics	1	C	70-84					7,5
Heat and moisture engineering	1	C	70-84					7,5
Track: Structural engineering								
Finite element method - applications	1	E	70-84					7.5
Timber engineering	1	E	70-84					7.5

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Geotechnics	1	E	70-84					7,5
Structural concrete	1	E	70-84					7,5
Applied structural dynamics	2	E	70-84					7,5
Steel structures	2	E	70-84					7,5
Material mechanics	2	E	70-84					7,5
Concrete structures	2	E	70-84					7,5
Master's thesis	2	E	70-84					7,5
Track: Building performance design								
Building physics	1	E	70-84					7,5
Introduction to sound and vibration	1	E	70-84					7,5
Indoor climate and HVAC	1	E	70-84					7,5
Building technology and services enginering	2	E	140-168					15
Resource efficient buildings	2	E	140-168					15
Master's thesis	2	C						30 or 60
Chalmers University of Technology			*Consecutive Master in* ***Sound and Vibration***					
Audio Technology & Acoustics	1	C	70-84					7,5
Techcical acoustics 1	1	C	70-84					7,5
Sound and vibration measurements	1	C	70-84					7,5
Individual preparation course	1	C	20					7,5
Building acoustics and community noise	1	E	70-84					7,5
Human response to sound and vibration	1	E	70-84					7,5
Technical acoustics 2	1	E	70-84					7,5
Room acoustics	1	E	70-84					7,5
Active noise control	2	E	70-84					7,5
Electro acoustics and ultrasonics	2	E	70-84					7,5
Design of silent products	2	E	70-84					7,5
Master's project	2	C						30 or 60

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Slovak University of Technology in Bratislava			*Consecutive Master in* ***Civil Engineering Structures***					
Concrete structures II	1	C	52	26	13	0	13	5
Steel bridges structures	1	C	52	26	13	0	13	5
Structural analysis	1	C	52	26	26	0	0	5
Railroads	1	C	52	26	13	0	13	5
Mathematics	1	C	52	26	26	0	0	5
Concrete bridges structures I	1	C	52	26	13	0	13	5
Subgrade structures	1	C	52	26	13	0	13	5
Structural dynamics	1	C	52	26	26	0	0	5
Urban roads	1	C	52	26	13	0	13	5
Elective subject I: Either Composite structures or Ground structures	1	E	52	26	13	0	13	5
Elective subject II: Either Steel bridges structures II or Tall and large-spane steel structures	1	E	52	26	13	0	13	5
Project I	1	C	39	0	0	0	39	5
Project II	1	C	39	0	0	0	39	4
Concrete bridges structures II	2	C	52	26	13	0	13	5
Geomechanics	2	C	52	26	26	0	0	5
Crossroads	2	C	39	13	13	0	13	4
Building and bussines law	2	C	26	26	0	0	0	3
Elective subject III (list): Tall and large-spane concrete structures Buckling and plasticity of steel structures Soils behaviour Statics and dynamics of tall buildings	2	E	52	26	13	0	13	5
Elective subject IV (list): Advanced concrete structures Tall and large-spane steel structures	2	E	39	26	13	0	0	4

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Engineering geology and hydrogeology Reliability and serviceability of structures								
Building economy and management	2	C	24	24	0	0	0	1
Elective subject V (list): Reconstruction of concrete structures Timber structures Advanced foundations Interaction structure-foundation	2	E	36	24	12	0	0	5
Elective subject VI (list): Concrete structures technology Thin walled steel structures Dumping sites and sludge beds Aeroelasticity and seismicity of structures	2	E	36	24	12	0	0	5
Experimental testing of structures	2	C	36	0	0	36	0	2
Excursion	2	C	1 week					
Physical training	2	C	24	0	24	0	0	0
Elective subject VII (list): Prestressed structures Diagnostics of steel &timber structures Advanced steel &timber structures Reconstruction of geotechnical construct. Subgrade constructions II Advanced structural dynamics Numerical experiments in structural engineering	2	E	36	24	12	0	0	5

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Diploma project	2	C	111	0	0	0	111	12
Slovak University of Technology in Bratislava			*Consecutive Master in* ***Building Engineering Structures***					
Prestressed concrete structures	1	C	52	26	13	0	13	5
Soils and rocks behaviour	1	C	52	26	26	0	0	5
Structural analysis	1	C	52	26	26	0	0	5
Elective subject I: Either Steel and timber structures Or Steel bridges structures	1	E	52	26	13	0	13	5
Mathematics	1	C	52	26	26	0	0	5
Project I	1	C	39	0	0	0	39	5
Elective subject II: Either Masonry structures Or Concrete bridges structures	1	E	52	26	13	0	13	5
Elective subject III: Either Flat and deep foundation Or Subgrade structures	1	E	52	26	26	0	0	5
Structural dynamics	1	C	52	26	13	0	13	5
Tall and large-spane steel structures	1	E	52	26	13	0	13	5
Disturbs of buildings	1	E	52	26	13	0	13	5
Project II	1	C	39	0	0	0	39	5
Advanced concrete structures	2	C	36	24	12	0	0	4
Building pits	2	C	36	24	12	0	0	4
Buckling and plasticity of steel structures	2	C	36	24	12	0	0	4
Elective subject IV: Either Two & three dimensional structures or Statics & dynamics of tall structures	2	E	36	24	12	0	0	5
Project III	2	C	36	0	0	0	36	5
Experimental testing of structures	2	C	36	0	0	36	0	4
Advanced building constructions	2	C	48	24	24	0	0	5

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Building and bussines law	2	C	36	24	12	0	0	3
Building economy and management	2	C	36	24	12	0	0	4
Elective subject V (list): Composite structures Reconstruction in geotechnics Diagnostics & reconstruction of steel & timber structures Interaction structure - foundation	2	E	48	24	24	0	0	5
Elective subject VI (list): Reconstructions of concrete structures Engineering geology Advanced steel &timber structures Aeroelasticity and seismicity of structures	2	E	48	24	24	0	0	5
Diploma thesis	2	C	111	0	0	0	111	12
Excursion	2	C	1 week					
Physical training	2	C	24	0	24	0	0	0
Slovak University of Technology in Bratislava			*Consecutive Master in* ***Transportation Engineering***					
Concrete structures II	1	C	52	26	13	0	13	5
Steel bridges structures I	1	C	52	26	13	0	13	5
Structural analysis	1	C	52	26	26	0	0	5
Railroads	1	C	52	26	13	0	13	5
Mathematics	1	C	52	26	26	0	0	5
CAD in transportation engineering	1	C	52	26	13	0	13	5
Concrete bridges structures	1	C	52	26	13	0	13	5
Steel bridges structures II	1	C	52	26	26	0	0	5
Subgrade structures	1	C	52	26	13	0	13	5
Urban roads	1	C	52	26	13	0	13	5
Airports and their infrastructure	1	C	52	26	13	0	13	5
Project I	1	C	39	0	0	0	39	5

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Crossroads	2	C	36	12	24	0	0	5
Reconstruction of transportation construct.	2	C	48	24	24	0	0	5
Prognostics in transportation engineering	2	C	48	24	24	0	0	5
Elective subject I (list): Experimental testing Structural elements in transp. eng. Traffic survey &analysis	2	E	36	12	24	0	0	5
Elective subject (list): Mechanics of pavement Railway stations and traffic nods Integrated traffic networks	2	E	48	24	24	0	0	5
Elective subject III: Advanced airport structures Urban planning Dynamics of railway drive	2	E	48	24	24	0	0	5
Building and bussines law	2	C	24	24	0	0	0	2
Building economy and management	2	C	24	24	0	0	0	2
Elective subject IV : Advanced road &railroad structures Traffic management High speed railroads	2	E	36	24	12	0	0	5
Elective subject V: CAD in transportation engineering Geoinformatic technologies Traffic town-planning	2	E	24	24	0	0	0	4
Infrastructure &environment	2	C	48	24	24	0	0	5
Excursion	2	C	1 week					

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Physical training	2	C	24	0	24	0	0	0
Diploma project	2	C	111	0	0	0	111	12
University of Žilina			*Consecutive Master in* ***Bridges and Tunnels***					
Applied Mathematics	1	C	4	2	2			5
Engineering Geology	1	C	4	2	2			4
Elasticity and Plasticity	1	C	4	2	2			5
Concrete Structures	1	C	4	2	2			5
Steel Structures	1	C	4	2	2			5
Structural mechanics	1	C	4	2	2			4
Tunnels 1	1	C	4	2	2			5
Concrete Bridges 1	1	C	4	2	2			5
Steel Bridges 1	1	C	4	2	2			5
Bridges – Project	1	C	2				2	2
Structural Reliability	1	C	2	1	1			4
Structural Dynamics	1	C	4	2	2			5
Practice	1	C	2					1
Excursion	1	C	1					1
Pavement Mechanics	1	E	4	2	2			5
Railway Mechanics	1	E	4	2	2			5
CAD/CAM/CAE 1	1	E	2			2		2
Transport Engineering	1	E	4	2	2			5
Urban Communications	1	E	3	2	1			4
Infrastructure Planning	1	E	3	2	1			3
Material Engineering	1	E	4	2		2		4
CAD/CAM/CAE 2	1	E	2			2		2
Experimental Analysis	1	E	3	2		1		3
Tunnels 2	2	C	4	2	2			5
Steel Bridges 2	2	C	4	2	2			5
Concrete Bridges 2	2	C	4	2	2			5
Bridges – Project 2	2	C	2				2	2
Personal Management	2	C	2	2				3
Project	2	C	4	2	2			5

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Management								
Technological Structures	2	C	3	2	1			4
Diploma Thesis	2	C	6				6	15
EIA	2	E	3	2	1			4
FEM	2	E	4	2	2			5
Timber Bridges	2	E	4	2	2			4
Urban Railways	2	E	4	2	2			4
Airports	2	E	4	2	2			3
Structural Stability and Plasticity	2	E	4	2	2			5
Intelligent Transport System	2	E	3	2	1			3
Building Law	2	E	2	2				3
Physical Training	1, 2	F	2		2			1
University of Žilina			*Consecutive Master in* ***Technology and Construction Management***					
Applied Mathematics	1	C	4	2	2			5
Engineering Geology	1	C	4	2	2			4
Economics of Building Business	1	C	4	2	2			5
Theory of Modeling	1	C	4	2	2			5
Information Systems	1	C	4	2	2			5
Project 1	1	C	2				2	2
Pavement Mechanics	1	E	4	2	2			5
Airports	1	E	4	2	2			3
CAD/CAM/CAE 1	1	E	2			2		2
Logisticks	1	E	4	2	2			5
Tunnels	1	C						
Concrete Bridges 1	1	C	4	2	2			5
Time Planning	1	C	2	2				3
Material Engineering	1	C	4	2		2		4
Project 2	1	C	2				2	2
Diagnostics of Transport Structures	1	C	4	2	2			4
Practice	1	C	2					1
Excursion	1	C	1					1
Urban Communications	1	E	3	2	1			4
Infrastructure Planning	1	E	3	2	1			3
Information Systems	1	E	4	2	2			4

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Water Transport	1	E	4	2	2			4
Maintenance and Reconstr. of Transp. Structures	2	C	4	2	2			4
Metrology	2	C	4	2	2			5
Infrastructure Management System	2	C	4	2	2			4
Quality Management	2	C	4	2	2			5
Project Financing	2	C	4	2	2			5
Project 3	2	C	2				2	3
Infrastructure Administration	2	C	3	2	1			4
Personal Management	2	C	2	2				3
Project Management	2	C	4	2	2			5
Economics of Railways	2	C	4	2	2			4
Diploma Thesis	2	C	6				6	15
EIA	2	E	3	2	1			4
Urban Engineering	2	E	4	2	2			5
Tunnels 2	2	E	4	2	2			5
Chapters from Geotechnika	2	E	4	2	2			4
Building Law	2	E	2	2				3
University of Žilina			*Consecutive Master in* ***Bearing Structures of Buildings***					
Applied Mathematics	1	C	4	2	2			5
Engineering Geology	1	C	4	2	2			4
Elasticity and Plasticity	1	C	4	2	2			5
Concrete Structures	1	C	4	2	2			5
Steel Structures	1	C	4	2	2			5
Structural mechanics	1	C	4	2	2			4
Atelier 1	1	C	3				3	3
Masonry Structures	1	C	4	2	2			5
Foundation of Structures	1	C	4	2	2			5
Timber Structures	1	C	4	2	2			4
Building Structures 1	1	C	4	2	2			5
Atelier	1	C	3				3	3
Practice	1	C	2					1
Excursion	1	C	1					1
Quality Management	1	E	4	2	2			5

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Material Engineering	1	E	4	2		2		4
Structural Dynamics	1	E	4	2	2			5
Chapters from Geotechnika	2	C	4	2	2			4
Structural Stability and Plasticity	2	C	4	2	2			5
Diagnostics and Reconstr. Of Building Structures	2	C	4	2	2			5
Building Structures 2	2	C	4	2	2			5
Atelier 3	2	C	3				3	3
FEM	2	E	4	2	2			5
Economics of Building Business	2	E	4	2	2			5
Project Management	2	C	4	2	2			5
Structural Reliability	2	C	2	1	1			4
Building Failures	2	C	2	2				4
Diploma Thesis	2	C	6				6	15
Information Systems	2	E	4	2	2			4
Experimental Analysis	2	E	3	2		1		3
Metrology	2	E	4	2	2			5
Physical Training	1, 2	F	2		2			1

B) MASTER PLUS PROGRAMMES

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Ecole Nationale des Ponts et Chaussées			*Master plus programmes*					
Advanced calculation of structures	1	C	40	20	20			4
Constructions calculation basis	1	C	20	10	10			2
Public works contracts and European directives	1	C	30	30				3
Fires physics	1	C	15	10	5			1,5
Steel constructions	1	C	40	20	20			4
Project economy	1	C	30	30				3
Engineering climatology	1	C	15	15				1,5
Reinforced and prestressed concrete	1	C	70	40	30			7
Bridges design	1	C	40	40				4
Geotechnical engineering	1	C	40	20	20			4
Service, pathology and repairing of works	1	C	40	40				4
Bridge project	1	C	80	20	20		40	8
Design of structures	1	C	80	20	20		40	8
Professional thesis	1	C	300				300	30
Building design	1	C	40	40				4
Paraseismic design	1	E	30	30				3
Constructions dynamics	1	E	20	20				2
Tunnels	1	E	40	20	20			4
Construction management	1	E	40	40				4

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
INSA Lyon[1]			*Master plus programmes :* ***Master MEGA "Civil Engineering"***[2]					
Continuum mechanics and thermodynamics	1	E	24	20				6
Systemics and system modelling	1	E	24	20				6
Numerical methods in civil Engineering	1	E	24	20				6
Experimentation and modelling	1	E	24	20				6
Geotechnics: soil structure interaction	1	E	24	20				6
Dynamics of soils and structures	1	E	24	20				6
Thermics and aeraulics modelling	1	E	24	20				6
INSA Lyon			*Master plus programmes:* ***Industrial and urban environmental sciences***[3]					
Industrial environment	1	E	24	24				6
Geosciences and dynamics of Eco-systems	1	E	24	24				6
Waste and smoke treatment	1	E	24	24				6
Bio-phsysical-chimical mechanisms	1	E	24	24				6
Social representation and acceptability of risks	1	E	24	24				6

1 Note: In France, there is officially common degree named Master. But for doctoral studies a specific master degree (research master) is generally needed. In the Civil Engineering field the general admission requirement is a BAC+ 5 curricula (except for the students in an Ecole d'Ingénieurs who have the possibility to follow simultaneously the "research master program" and their last year of Ecole d'Ingénieurs)

2 *The students have to choose 5 courses (6 ECTS credit each)*

- *1 course type TCDE (4 choices)*
- *1 course type TCDEA (3 choices)*
- *2 courses in a list of 11 (OSHU or OMS or OBE)*

Examples of these 3 types of courses are:

3 *The students have to choose 5 courses (6 ECTS credit each) in five main areas*

Examples of these 5 types of courses are:

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Institut Supérieur du Bâtiment et des Travaux Publics			*Master plus programmes**: Engineer specialization program in bridge design***					
Soil mechanics 1	1	C	40	40				2
Paraseismic structures	1	C	36	36				2
Steel structures	1	C	44	44				2
Reinforced concrete structures	1	C	68	68				2
Sructures modelisation	1	C	32	8		24		2
Building design	1	C	36	36				2
Construction cost	1	C	28	28				1
Construction law	1	C	20	20				1
Contracts	1	C	16	16				1
English	1	C	40		40			1
Prestressed concrete	1	C	40	40				3
Bridge design	1	C	52	52				4
Bridge project	1	C	150				150	10
Building project	1	C	150				150	10
Technical study	1	C	56				56	2
Company training	1	C					600	30
Institut Supérieur du Bâtiment et des Travaux Publics			*Master plus programmes**: Specialization engineer diploma in infrastructures and geotechnics***					
Soil mechanics 1	1	C	40	40				2
Paraseismic structures	1	C	36	36				2
Steel structures	1	C	44	44				2
Reinforced concrete structures	1	C	68	68				2
Sructures modelisation	1	C	32	8		24		2
Building design	1	C	36	36				2
Construction cost	1	C	28	28				1
Construction law	1	C	20	20				1
Contracts	1	C	16	16				1
English	1	C	40		40			1
Soil mechanics 2	1	C	28	28				2
Offshore structures	1	C	24	24				2
Tunnels	1	C	24	24				2
Dams	1	C	16	16				1
Infrastructure project	1	C	150				150	10
Building project	1	C	150				150	10
Technical study	1	C	56				56	2

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Company training	1	C					600	30
National Technical University of Athens			*Master plus programme:* ***Water Resources Science and Technology*** [1]					
Advanced hydrology		C1	39	39				
Hydrometeorology		E1	39	39				
Advanced hydrogeology		E1	39	39				
Groundwater hydrology and pollutant transport		E1	39	39				
Water resources management		E1	39	39				
Floods and flood protection works		E1	39	39				
Advanced wastewater treatment methods		C2	39	39				
Management of solid wastes and sludges		E2	39	39				
Topics in water chemistry and microbiology		E2	39	39				
Management of aquatic ecosystems-Sustainable development		E2	39	39				
Production of drinking and reclaimed water		E2	39	39				
Mathematical modeling of pollutant transport and water quality		E2	39	39				
Environmental hydraulics		C3	39	39				
Maritime hydrodynamics		E3	39	39				
Coastal environment		E3	39	39				
Numerical methods in the coastal zone		E3	39	39				
Coastal zone development		E3	39	39				
Protection works of the coastal environment		E3	39	39				

[1] with 3 subspecializations: Hydrology and Environmental Management of Water Resources (C1-E1), Water Quality and Environmental Technology (C2-E2), Coastal Zone Management (C3-E3)

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
Partial differential equations		E	39	39				
Advanced numerical analysis		E	39	39				
Soil erosion, sediment transport and deposition		E	39	39				
Laboratory methods in sanitary engineering		E	39	9		30		
Technology and management of rural development works		E	39	39				
GIS in water resources		E	39	39				
Advanced fluid mechanics		E	39	39				
Dams		E	39	39				
Restoration of contaminated sites		E	39	39				
Water resources systems optimization		E	39	39				
Urban hydrology		E	39	39				
Exploitation, management and protection of aquifers		E	39	39				
Decentralized wastewater management		E	39	39				
Environmental impact of hydraulic works		E	39	39				
Sea outfalls		E	39	39				
National Technical University of Athens			*Master plus programme:* ***Design and Construction of Underground Works***					
Engineering geology for underground works		C	39	39				
Site investigation methods		C	39	39				
Advanced rock mechanics		C	26	26				
Design of underground works		C	39	39				
Design and techno-economic analysis of selected		C	26	26				

Name of course unit (in English)	Year of study	Type C/E/ F*	Contact hours					ECTS credits
			Total contact hours	From which spent on**				
				L	CL	LAB	P	
underground works								
Computational methods in the design of underground works		C	39	39				
Explosives and rock blasting		C	26	26				
Support of underground excavations		C	39	39				
Mechanized tunneling		C	39	39				
Shallow tunnels: Retaining structures and deformations at ground surface		C	39	39				
Tunnel portals and slope stability		C	39	39				
Geotechnical instrumentation		E	26	20		6		
Mine ventilation engineering		E	26	26				
Seismic design for tunnels		E	26	26				
University of Patras			*Master plus programmes in:* **Seismic Design of Structures Geotechnical Engineering Water Resources and Environment Transportation, Construction Management and Spatial Planning**					
Earthquake Engineering and Seismic Structures	1	E	51	36	-	-	15	
Advanced Engineering Mechanics	1	E	51	36	-	-	15	
Technical Seismology	1	E	51	36	-	-	15	
Seismic Design of Concrete Structures	1	E	51	36	-	-	15	
Seismic Design of Steel Structures	1	E	51	36	-	-	15	
Retrofitting of Existing Structures	1	E	51	36	-	-	15	
There are 9 more elective courses plus the M.Sc Thesis.								
The students are obliged to study in 8 elective courses. The M.Sc Thesis is also compulsory for any student								

ANNEX III

EUCEET III Survey on geo-engineering sciences in the curricula of various degree programmes

FIRST-CYCLE DEGREE PROGRAMMES OF 3 YEARS DURATION (180 ECTS)

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Catholic University Leuven			***BSc in Geotechnics and Mining Engineering***									
Environmental problems and technics	2	C	59	32	27					x		6
Elasticity and plasticity	3	C	60	30	30					x		6
Rock mechanics	3	C	59	34	25					x		6
Soil mechanics	3	C	56	36	20					x		6
Geophysics, potential methods	3	C	57	34	23					x		6
Project, Geological mapping and surveying	3	C	65				65				x	4
Project, Geotechnics	3	C	60				60				x	4
Milan University of Technology			***Bachelor in Environmental and Land Planning Engineering***									
Engineering Geology 1	2	C	50	30	20	-	-			x		5
Soil Mechanics with Laboratory	2	C	75	45	20	15	-			x		7.5
Milan University of Technology			***Bachelor in Building Engineering***									
Geotechnical Engineeringng	3	C	50	30	20					x		5
Milan University of Technology			***Bachelor in Architecture Science***									
Applied Soil Mechanics	3	E	50	30	20					x		5
Beira Interior University			***Bachelor in Civil Engineering***									
Engineering Geology	1	E	64	32	22	10		4				6

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours										ECTS credits
			Total contact hours	From which spent on**									
				L	CL	LAB	P	Assessment					
								Exams***			Other form		
								W	O	W &O			
Soil Mechanics	3	E	64	32	16	16		4					6
University of Žilina			***Bachelor in Civil Engineering***										
Geology	1	C	56	28	28					x			6
Hydraulics and Hydrology	1	C	56	28	28					x			6
Geomechanics	2	C	56	28	14	14				x			6
Foundations Engineering	2	C	56	28	28					x			5
Engineering Geology	2	C	42	28	14					x			4
Geomechanics Laboratories	2	E	28			28		x					2
Catholic University of Louvain			***Bachelor in engineering sciences, orientation civil engineering***										
Geology	2	C	40	25	15					x			4
Soil Mechanics	3	C	47,5	25	22,5					x			4
Applied Soil Mechanics	3	C	52,5	30	22,5					x			5
University of Pisa			***Bachelor degree in Civil, environmental and territory engineering***										
Geotechnics	3	C	90	70		20		x					9
Cardiff University			***B.Eng. (Hons) Architectural Engineering***										
Architectural Engineering & Soil Mechanics	1	C	36	24	12			40			60		
Laboratory	1	C	36			36					100		
Soil Mechanics	2	C	36	36				100					
Laboratory	2	C	36			36					100		
Geotechnical Engineering	3	C	36	36				100					
Project	3	C	180				180		15		85		
Environmental Geotechnics	3	E	36	36				100					

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Cardiff University			***B.Eng. (Hons) Civil Engineering***									
Engineering Geology & Soil Mechanics	1	C	36	36				100				
Laboratory	1	C	36			36					100	
Soil Mechanics	2	C	36	36				100				
Laboratory	2	C	36			36					100	
Geotechnical Engineering	3	C	36	36				100				
Project	3	C	180				180		15		85	
Civil Engineering Design	3	C	36	12	24						100	
Environmental Geotechnics	3	E	36	36				100				
Helsinki University of Technology			***Bachelor program in civil engineering***									
Basics of engineering geology	1	C	54	27	27			x				4
Principles of geomechanics	2	C	50	26	16	8		x				4
Basic course in geotechnics	3	E	60	30	30			x				5
Geotechnics of structures*)	3	E	54	24	20		10	x				5
Community geotechnics**)	3	E	54	24	20		10	x				5
Bachelor's thesis and seminar	3	C										10
University of Nantes			***Bachelor in Engineering Sciences***									
Soil Mechanics	3	C	48	18	18	12		x	-	-	-	5
Milan University of Technology			***Bachelor in Civil Engineering***									
Engineering Geology	1	C	50	30	20	-	-			x		5
Geotechnical Engineering	3	C	120	70	50	-	-			x		10
Milan University of Technology			***Bachelor in Civil and Environmental Engineering***									
Engineering Geology	2	C	50	30	20	-	-			x		5
Geotechnical Engineering	3	C	100	60	40	-	-			x		10

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Rzeszów University of Technology			***Specialization Civil Engineering***									
Geology	1	C	45	15	30			x				3
Soil Mechanics and Foundation	2	C	105	45		30	30			x		9
Field Training of Soil Mechanics and Foundation	2	C	60			60		x				

* C = Compulsory; E=elective; F=facultative
** L - lectures; CL – class work; LAB – laboratory work; P – project;
*** W=written; O=oral

*) For structural students, **) For municipal students

FIRST-CYCLE DEGREE PROGRAMMES OF 4 YEARS DURATION (240 ECTS)

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Technical University of Civil Engineering Bucharest			***Engineers degree in Civil, Industrial and Agricultural Buildings***									
Engineering Geology	2	C	28	14		14			x			2
Geotechnical engineering	3	C	70	42		28				x		5
Foundation engineering	3	C	70	42			28					2+2
Technical University of Civil Engineering Bucharest			***Engineers degree, Specialization: Construction Management***									
Geotechnical engineering	3	C	56	28		28			x			4
Foundations and foundation procedures	3	C	56	28			28		x			2+2
Technical University of Civil Engineering Bucharest			***Engineers degree, Specialization: Hydrotechnical Works and Structures***									
Engineering geology	2	C	42	28		14			x			2
Geotechnical engineering	3	C	70	42		28			x			5
Foundations engineering	3	C	56	28			28		x			2+2
Technical University of Civil Engineering Bucharest			***Engineers degree, Specializations: Railways, Roads and Bridges, Infrastructure of Metropolitan Transports***									
Engineering geology	2	C	42	28		14			x			2
Geotechnical engineering	3	C	70	42		28			x			5
Foundation engineering	3	C	42	28		14			x			4
Foundation Engineering	4	C	42	28		14			x			3

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Technical University of Civil Engineering Bucharest			***Engineers degree, Specialization: Hidrotechnics and Environmental Engineering***									
Engineering geology	2	C	28	14		14			x			3
Foundations engineering	3	C	70	42			28		x			3+2
Heriot Watt University			***Bachelor programme in Civil Engineering***									
Geology and soil mechanics	2	C	48	x	x	x		x				7.5
Geotechnics A	3	C	48	x	x	x		x				7.5
Geotechnics A	4	C	48	x	x			x				7.5
Geotechnics A	4	E	48	x	x			x				7.5
Technological Educational Institute of Peiraeus			***Specialization: Engineering of Building Construction***									
Engineering Geology	1	C	4	2		3		3				4
Soil Mechanics	3	C	6	3		3		3				7
Engineering Foundation	4	C	6	3		3		3				7
Technological Education Institute of Serres			***Specialization: Civil Engineering***									
Engineering Geology	1st	C	4	2		2		4				5
Soil Mechanics	2nd	C	5	2		3		5				5
Applications of Engineering Geology in Civil Engineering	4th	E	4	2		2		4				5
Warsaw University of Technology			***Specialization: Engineering Structures***									
Engineering Geology	2	C	45	x	x	x				x		3
Soil Mechanics and Geotechnical Engineering - 1	3	C	60	x		x	x			x		4
Soil Mechanics and Geotechnical Engineering – 2	3	C	60	x		x	x			x		4
Underground Structures	3	C	30	x			x			x		2

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Rzeszow University of Technology			***Specialization: Civil Engineering***									
Geology	1	C	30	15	15			x				4
Soil Mechanics and Foundation I	2	C	40	15		20				x		5
Soil Mechanics and Foundation II	3	C	30	15			15	x				6
Rzeszow University of Technology			***Specialization: Environmental Engineering***									
Hydrology and Earth Sciences	2	C	30	15	15			x				4
Soil Mechanics and Geotechnics	2	C	20	10		10		x				3
Technical University "Gh. Asachi" Iasi			***Specialization: Civil, Industrial and Agricultural Constructions***									
Engineering Geology	2	C	28	14		14				x		3
Geotechnics	3	C	56	42		14				x		5
Foundations	3	C	70	42			28			x		5
Special Foundations	4	E	42	28	14				x			3
Technical University "Gh. Asachi" Iasi			***Specialization: Transportation Infrastructure***									
Engineering Geology	2	C	28	14		14				x		3
Geotechnics	3	C	56	42		14				x		5
Foundations	3	C	56	28			28			x		5
Tunnels and Metropolitans	4	C	42	28	14					x		4
Advanced Geotechnics and Foundations	4	E	42	28	14				x			3
Middle East Technical University Ankara			***Specialization: Civil Engineering***									
Soil Mechanics	3	C	5	3		2		x				5
Foundation Engineering	3	C	4	2	2			x				4

* C = Compulsory; E=elective; F=facultative
** L - lectures; CL – class work; LAB – laboratory work; P – project;
*** W=written; O=oral

SECOND-CYCLE DEGREE PROGRAMMES (CONSECUTIVE MASTER)

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Heriot Watt University			***Master of Science in Geotechnical Engineering 1 year programme (90 ECTS)***									
Geological Techniques in Site Investigation	1	C	48	x	x							7.5
Environmental Geotechnics	1	C	48	x	x							7.5
Critical State Soil Mechanics	1	C	48	x	x							7.5
Foundation Engineering	1	C	48	x	x							7.5
Ground Engineering	1	C	48	x	x							7.5
Rock Mechanics	1	C	48	x	x							7.5
Numerical Analysis	1	C	48	x	x							7.5
Geotechnical Design Studies	1	C	48	x	x							7.5
Dissertation/ Thesis	1	C					x				x	30
Cardiff University			***Master of Science - Specialization: Civil Engineering 1 year programme***									
Engineering Geology	1	C	36	36				100				
Engineering Case Study	1	C	72				72				100	
Dissertation	1	C	180				180				100	
Theoretical Soil Mechanics	1	E	36	36				100				

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Cardiff University			***Master of Science - Specialization: Geoenvironmental Engineering 1 year programme***									
Engineering Geology	1	C	36	36				100				
Soil & Groundwater Chemistry	1	C	36	36				75			25	
Land Contamination	1	C	36	36				100				
Geoenvironmental Engineering Applications	1	C	72	72							100	
Geo- & Hydro-environmental Modelling	1	C	36	12		24		50			50	
Engineering Case Study	1	C	72				72				100	
Dissertation	1	C	180				180				100	
Helsinki University of Technology			***Master of Science – Specialization: Civil Engineering 2 years programme (120 ECTS)***									
Geotechnics of structures**)	3	E	54	24	20		10	x				5
Community geotechnics*)	3	E	54	24	20		10	x				5
Geotechnical design	4	E	57	32	20		5	x				5
Advanced soil mechanics	4	E	60	30	15	10	5	x				5
Numerical methods of geotechnics	4-5	E	54	24	25		5	x				5
Environmental geotechnics	4-5	E	54	24	20			x			Present ation	4
Seminar on foundation engineering and soil mechanics	4-5	E	36	36							Paper + presentation	3
Foundation engineering and soil mechanics, Special assignment	4-5	E	5				5				Paper	3-6

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Catholic University Leuven			***Master of Science – Specialization: Geotechnics and Mining Engineering 2 years programme (120 ECTS)***									
Numerical discretisation methods	1	C	60	33	27					x		6
Hydrogeology	1	C	54	33	21					x		6
Mining methods	1	C	40	22	18					x		4
Geostatistics	1	C	43	22	21					x		4
Geophysics, seismic and radar	1	C	58	34	24					x		6
GIS	1	C	32	20	12					x		3
Wave propagation	1	C	42	22	20					x		4
Project, Geotechnics	1	C	58				58				x	3
Rock mechanics, destruction	2	C	22	22						x		3
Petroleum engineering	2	C	22	22						x		3
Project, Geophysics	2	C	45				45				x	3
Soil mechanics, applications	2	C	51	40	11					x		6
Catholic University of Louvain			***Master of Science – Specialization: Civil Engineering 2 years programme (120 ECTS)***									
Applied geotechnic	4	C	45	30	15					x		4
Design and geotechnical control	4	C	45	30			15			x		4
Rock mechanics and underground works	4 or 5	F	30	30					x			3
Hydrology	4 or 5	F	30	30					x			3
Thermo-hydro-mechanical behavior	4 or 5	F	20	20					x			3
Dynamic of soils	4 or 5	F	20	20					x			3

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Numerical modeling of geomaterials	4 or 5	F	35	20			15			x		3
Geoenvironment	4	C	45	30	15					x		4
Integrated project in civil engineering	5	E					60	x				4
Specialized project	5	E					30	x				2
University of Nantes			***Master of Science – Specialization: Civil Engineering 2 years programme (120 ECTS)***									
Geotechnical Engineering	1	C	40	16	16	8	-	x	-	-		3
Foundation Engineering	2	C	40	16	16	8	-	x	-	-		3
University of Pisa			***Master of Science – Specialization:*** ***• Hydraulic, Transportation and Territory Engineering*** ***• Building Engineering*** ***2 years programme (120 ECTS)***									
Foundation & Retaining walls (*****)	1	C	60	50			10			x		6
Pile foundations (****)	1	E	60	50			10			x		6
Geotechnics (****)	1	C	90	70			20	x				9
Geophysical Testing (*****)	2	C	90	70		20			x			9
Applied Geology (*****)	1	E	90	60			30		x			9
Milan University of Technology			***Master of Science in Civil Engineering 2 years programme (120 ECTS)***									
Environmental geotechnics	1	C/E	50	30	20				x			5
Engineering Geology II	2	C/E	50	30	20	-	-		x			5
Underground constructions	2	C/E	50	30	20	-	-		x			5
Foundation Engineering	2	C/E	96	60	36		-		x			10
Slope stability	2	C/E	96	60	36				x			10
Engineering seismology	1/2	E	96	60	36				x			10

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours										ECTS credits
			Total contact hours	From which spent on**									
								Assessment					
								Exams***					
				L	CL	LAB	P	W	O	W &O	Other form		
Milan University of Technology			***Master of Science in Civil Engineering 2 years programme (120 ECTS)***										
Soil structure interaction	1	C	100	60	40					x		10	
Geological Risk Assessment	2	E	50	30	20	-	-		x			5	
Milan University of Technology			***Master of Science – Specialization: Environmental and Land Planning Engineering 2 years programme (120 ECTS)***										
Engineering Geology	1	C	50	30	20	-	-			x		5	
Geotechnical Engineering with Laboratory	2	E	92	36	32	24	-			x		7.5	
Milan University of Technology			***Master of Science – Specialization: Architecture 2 years programme (120 ECTS)***										
Foundations and Retaining Wall	2	E	40	25	15	-	-			x		4	
Milan University of Technology			***Master of Science – Specialization: Building Engineering 2 years programme (120 ECTS)***										
Foundation Engineering	2	E	50	30	20					x		5	
Warsaw University of Technology			***Master of Science – Specialization: Engineering Structures 2 years programme (120 ECTS)***										
Underground Constructions	1	C	90	x			x			x		8	
Computer Methods in Geo-technical Engineering	2	E	30			x					x	2	
Stability of Soil Structures	1	C	30	x			x				x	30	
Beira Interior University			***Master of Science – Specialization: Civil Engineering 2 years programme (120 ECTS)***										
Soil Mechanics advanced	1	E	64	32	20	12		4				6	
Foundations	1	E	64	32	18	8	6	4				6	
Environmental Geotechnics I	1	F	64	32	2	20	10	4				6	
Environmental Geotechnics I I	2	F	64	32	12	20		4				6	
Rock Mechanics	2	F	64	32	20	12		4				6	

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Works and Structures of Earth	2	F	64	32	9	13	10	4				6
University of Žilina			***Master of Science – Specialization: Civil Engineering 2 years programme (120 ECTS)***									
Engineering Geology	1	C	56	28	28		1			x		5
Underground Structures	1	C	56	28	28					x		5
Excursion	2	F	14	14							Presents	1
Applied Geotechnics	2	E	52	28		14				x		3
Middle East Technical University			***Master of Science – Specialization: Geotechnical Engineering 2 years programme (120 ECTS)***									
Advanced Soil Mechanics I	5	C	3	3				x				
Advanced Soil Mechanics II	5	C	3	3				x				
Deep Excavations And Retaining Structures	5	C	3	3				x				
Geotechnical Investigations	5	C	3	3				x				
Environmental Geotechnics	5	C	3	3				x				

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** L - lectures; CL – class work; LAB – laboratory work; P – project;
*** W=written; O=oral
*) For structural students, **) For municipal students
**** (the same subject taught at the 1° cycle Civil Engineering)
***** (taught at the Master course in Civil Engineering (Hydraulic, Transportation & Territory Engineering)

INTEGRATED 4-YEAR PROGRAMMES

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Cardiff University			***Master of Engineering - Specialization: Arhitectural Engineering***									
Architectural Engineering & Soil Mechanics	1	C	36	24	12			40			60	
Laboratory	1	C	36 (6 geotech)			36					100	
Soil Mechanics	2	C	36	36				100				
Laboratory	2	C	36 (6 geotech)			36					100	
Geotechnical Engineering	3	C	36	36				100				
Project	3	C	180				180		15		85	
Environmental Geotechnics	3	E	36	36				100				
Soil Mechanics	4	E	36	36				100				
Cardiff University			***Master of Science - Specialization: Civil Engineering***									
Engineering Geology & Soil Mechanics	1	C	36	36				100				
Laboratory	1	C	36 (6 geotech)			36					100	
Soil Mechanics	2	C	36	36				100				
Laboratory	2	C	36 (6 geotech)			36					100	

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Cardiff University			***Master of Engineering - Specialization: Arhitectural Engineering***									
Geotechnical Engineering	3	C	36	36				100				
Project	3	C	180				180		15		85	
Civil Engineering Design	3	C	36	12	24						100	
Environmental Geotechnics	3	E	36	36				100				
Design	4	C	72	24	48						100	
Soil Mechanics	4	E	36	36				100				
Cardiff University			***Master of Science - Specialization: Civil & Environmental Engineering***									
Engineering Geology & Soil Mechanics	1	C	36	36				100				
Laboratory	1	C	36 (6 geotech)			36					100	
Soil Mechanics	2	C	36	36				100				
Laboratory	2	C	36 (6 geotech)			36					100	
Geotechnical Engineering	3	C	36	36				100				
Project	3	C	180				180		15		85	
Civil Engineering Design	3	C	36	12	24						100	
Environmental Geotechnics	3	E	36	36				100				
Design	4	C	72	24	48						100	
Soil Mechanics	4	E	36	36				100				

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** L - lectures; CL – class work; LAB – laboratory work; P – project;
*** W=written; O=oral

INTEGRATED 5-year PROGRAMMES

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Tallinn University			***Master of Science - Specialization: Civil Engineering 5 year (300 ECTS)***									
Soil Mechanics and Engineering Geology	4	C	96	64	16	16		x				7,5
Foundations	4	C	80	48			20	x				5,3
Special Course of Geotechnical Design	5	E	80	64	16			x				6,0
Heriot Watt University			***Master of Engineering - Specialization: Civil Engineering 5 year***									
Geology and Soil Mechanics	2	C	48	x	x	x						7.5
Geotechnics A	3	C	48	x	x	x						7.5
Geotechnics A	4	C	48	x	x							7.5
Geotechnics A	4	E	48	x	x							7.5
Ground Engineering	5	E	48	x	x							7.5
Technical University Dresden			***Master of Engineering - Specialization: Civil Engineering 5 year (300 ECTS)***									
Soil Mechanics and Foundation Engineering	2-3	C	180	45	41	4	60	x				6
Geotechnics A, Tunnelling and Materials	3	E	240	60	30		30	x				8
Geotechnics B	4	E	240	45	30	15	60				x	8
Environmental Engineering - Soils	4	E	240	75	15		30	x				8
Numerical Methods in Geotechnics	4	E	240	60	30		50				x	8
University of Castilla-La Mancha			***Master of Engineering - Specialization: Civil Engineering 5 year (300 ECTS)***									
Ground Engineering	1	C	60	50	10	10		x				5

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Geomorfology	2	C	60	50	10	10		x				5
Soil mechanics	3	C	90	75	20	15		x				7
Transportation infrastructure	4	C	75	60	20	15				x		6
Dynamics of soils and foundations	5	F	50	50	20		10				x	5
CUST - Polytech'Clermont-Ferrand			***Master degree - Specialization: Civil Engineering 5 year (300 ECTS)***									
Geology	3	C	23	10	10	3		x				1 (5 with the course on materials)
Soil Mechanics and Geotechnique	4	C	60	22	22	16		x				4
Geotechnique, Design project	4	E					30			x		2
R&D Project in the Geotechnical Field	5	E	20				450			x		30
Soil Improvement and Soil Treatment	5	E	10		10					x		2.5
Numerical Modeling in Geotechnical Engineering	5	E	10		10					x		2.5
Foundations Design	5	E	10		10					x		2.5
Mechanics of Granular Media	5	E	10		10					x		2.5
Hazard in Soil Mechanics	5	E	10		10					x		2.5
Soil Investigation	5	E	10		10					x		2.5
Experimental Soil Theology	5	E	10			10				x		2.5

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
INSA de Lyon			***Master degree - Specialization: Civil Engineering and Urban Planning 5 year (300 ECTS)***									
Geotechnics 1: Engineering Geology	3	C	50	16	22	12				x		3
Geotechnics 2: Hydraulics and Soil Mechanics	3	C	62	22	26	14				x		4
Geotechnics3 : Soil Structure Design	4	C	68	34	34					x		4.5
Seismic design	4	E	16	16				x				Geotechnical topics : 25 %
Experimental methods in Civil engineering	4	E	16	16				x				Geotechnical topics : 25 %
Deep Excavations & Soil Improvement	5	E	24	24				x			Written project	2
Foundation Design	5	E	24	24				x			Written project	2
Rock Mechanics and Numerical Simulation	5	E	24	24				x			Written project	2
Natural and Anthropic Risks Analysis	5	E	96	86			10	x			Written project	8
Road Engineering	5	E	24	24				x				2,5

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Building Project (including foundation design)	5	E	220				192				Written project – Public defense	12 not only geotechnical topics
Public Works Project (including foundation design)	5	E	220				192				Written project – Public defense	12 not only geotechnical topics
R&D project in the geotechnical field	5	E	220				236				Written project –	13
National Technical University of Athens			***Specialization: Civil Engineering 5 year***									
Geology for Civil Engineers	1	C	52	52				x			Midterm exam (me),	
Soil Mechanics I	3	C	52	48		4		x			Midterm exams (me),	
Engineering Geology	3	C	39	39				x			Field work + report, ha	

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Soil Mechanics II	3	C	52	48		4		x			me, ha	
Foundations	4	C	65	65				x			me, ha	
Experimental Soil Mechanics	4 or 5	E	52	26		26		x			Lab reports	
Selected Topics in Foundation Engineering	4	E	52	52				x			Term project,	
Soil-Structure Interaction	4	E	52	52				x			Term projects	
Soil Dynamics	5	E	52	52				x			me, ha	
Rock Mechanics - Tunnels	5	E	52	52					x		Term projects	
Environmental Geotechnics	5	E	52	52				x			Term project, me, ha	
Computational Geotechnics	5	E	52	52				x			Term projects	
Selected Geotechnical Projects	5	E	39	39				x			ha	

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
Dams	5	E	52	52				x			Term project	
Milan University of Technology			***Specialization: Building Engineering 5 year (300 ECTS)***									
Geotechnical Engineering	4	C	100	70	50	-	-			x		9

* C = Compulsory; E=elective; F=facultative
** L - lectures; CL – class work; LAB – laboratory work; P – project;
*** W=written; O=oral

MASTER PLUS PROGRAMMES

Name of course unit (in English)	Year of study	Type C/E/F*	Contact hours									ECTS credits
			Total contact hours	From which spent on**								
				L	CL	LAB	P	Assessment				
								Exams***			Other form	
								W	O	W &O		
National Technical University of Athens			***1 year programme: "Design and Construction of Underground Works"***									
Engineering geology for underground works		C	39	39				x			Field work+report,	
Site investigation methods		C	39	39				x			Field work+report,	
Advanced Rock Mechanics		C	26	26				x			ha	
Design of underground works		C	39	39				x			Term project, ha	
Design and techno-economic analysis of selected underground works		C	26	26				x			ha	
Computational methods in the design of underground works		C	39	39				x			Term project	
Explosives and rock blasting		C	26	26				x			ha	
Support of underground excavations		C	39	39				x			ha	

Mechanized tunneling		C	39	39				x			ha	
Shallow Tunnels: Retaining Structures and Deformations at Ground Surface		C	39	39				x			Term project, ha	
Tunnel portals and slope stability		C	39	39				x			ha	
Geotechnical instrumentation		E	26	20		6		x			Term projects	
Mine ventilation engineering		E	26	26				x			ha	
Seismic design for tunnels		E	26	26				x			Term project, ha	
Technical University Dresden			***2 year programme (120 ECTS): "Rehabilitation Engineering"***									
Subsoil and Foundation	1	C	90	15	13	2		x				3

* C = Compulsory; E=elective; F=facultative
** L - lectures; CL – class work; LAB – laboratory work; P – project;
*** W=written; O=oral

THEME B: Enhancement of the cooperation between civil engineering faculties in Europe by the development of joint degrees

Report of the
Working Group

THEME B: ENHANCEMENT OF THE COOPERATION BETWEEN CIVIL ENGINEERING FACULTIES IN EUROPE BY THE DEVELOPMENT OF JOINT DEGREES

Report of Working Group
Radu BĂNCILĂ[1]

1. INTRODUCTION

Due to today's highly competitive job market and the globalization on one part and unstable job market on the other part, the educational process of young people is more important than ever. New possibilities to improve qualifications at higher education level are needed.

The enlargement of the European Union marked an enhancement of the study periods abroad in EU countries. It has become clear that in spite of the geographical location, language and culture differences between European countries, there is much more which unites than divides us.

In the European area of higher education, the international collaboration of universities requires the existence of a system of easily comprehensible and comparable degrees, which will lead to the improvement of the mobility of students and teachers.

Different possibilities were created, like the **Erasmus Programme** (***E**uropean **R**egion **A**ction **S**cheme for the **M**obility of **U**niversity **S**tudents*) which is a European Union (EU) student exchange programme established in 1987. The Erasmus Programme, together with a number of other programmes, was incorporated into the SOCRATES Programme established by the European Commission in 1994 and ended on 24 January 2000, to be replaced by the Lifelong Learning Programme (2007–2013).

Student exchange programmes, under Erasmus, provide the possibility of studying for one or two semesters at a partner university in another country, after which the student returns to his mother University. However, under this type of exchange programme the student cannot usually receive degree from the host University.

In the last decades, however, a new concept in educational cooperation began to take shape between some Universities, called the **Double Diploma**. These programmes allow students to earn simultaneously degrees from two different universities. With the acquisition of a double diploma, the graduate increases his chances for a good job, because the degree satisfies the

[1] Chairman of the Working Group for the Theme B; Prof. Dr. at "POLITEHNICA" University, Timisoara, ROMANIA,

requirements of both institutions and will be accepted in two countries. Generally speaking, most popular academic disciplines for collaborative degree programmes are Business and Management and Engineering.

The complementarity of two study courses and the qualities that the students develop within the framework of this in-depth intercultural experience, lead to a new type of engineer, well prepared to meet the international challenges posed by modern companies. During these international courses the student spends a certain amount of time at a partner University abroad. This arrangement is based on a cooperation-agreement between two (or more) universities. In contrast to the Erasmus programme, in this case the same performance from both foreign and from local students is expected. Good language ability already at the beginning of the studies is therefore an important condition for attending an international course. By the end of studies, students who lived in two different countries and were confronted with new and different experiences are better prepared for the future job in international companies.

Under the theme **"*Curricula issues and developments in civil engineering*",** the Specific Project 1 within EUCEET II prepared, on the base of a large consultation of partners, **"*Studies and recommendations on core curricula for various degree programmes*"**. A natural continuation of this activity is the development of joint degrees at both first cycle and second cycle. EUCEET is in a very good position to promote among its partners, and not only, such development, which will have a very favorable impact on the mobility of students and of future engineers.

The present report describes the possibilities and the general conditions of obtaining a Joint Degree or a Double Diploma in Civil Engineering, in the context of the internationalization strategy of the higher education system and according to the Bologna Process. Some examples in this direction are given and a case study concerning the students from the "Politehnica" University of Timisoara / Romania and the Technical University of Munich / Germany is presented. Finally, a proposal for a network involving EUCEET partners in a Double Diploma programme is presented.

2. DEFINITION OF TERMS

In the *Glossary of Terms Relevant to Higher Education Engineering,* prepared within the Thematic Network TREE – www.unifi.it/tree - the following definitions are given*:*

Double (or multiple) Degree:
A specific joint degree where the higher education institutions involved award their own degree to the students who fulfilled the prescribed requirements.

Joint Degree:
A higher education qualification issued jointly by two or more higher education institutions on the basis of a joint study program.

Other definitions were presented by Christoph Steber, Technical University of Munich [1]:

- **Joint** Integrated programme with one document (diploma) at the end:
  - Same duration at each university
  - Curricula are rigid/fixed, changes are difficult
  - Full recognition of the study.
- **Dual -** Mainly like a "Joint" but avoids the legal restrictions:
  - No extension
  - Often in English
  - Preset Programme (e.g. the Erasmus Mundus programme would be typically a dual).
- **Double** - Prolongation of the studies
  - Not preset
  - Student follows the normal courses
  - Two separate degrees
  - Different didactic methods of teaching
  - Language of instruction is often the language of the country.

As Kuder and Obst observed [2], a multitude of meanings exists behind the term *joint*, *dual* or *double degree*). Often enough these terms can be found to refer to programs that combine degrees in two academic disciplines yet are carried out entirely within one and the same higher education institution. Also, there is often a confusion about the difference between the terms dual and double. While in some countries the term *dual degree* is used more commonly for degree programs that feature structured curriculum cooperation with a foreign partner institution, other countries might prefer the term *double degree*. To avoid further confusion, for the purposes of the survey undertaken by the Working Group B, the definition of what constitutes an (international) *joint/dual/double* degree was brought down to two basic categories:

A. **joint degree program**: students study at (at least) two higher education institutions and receive upon completion of the study program a single degree certificate issued and signed jointly by all the participating institutions;
B. **dual or double degree program**: students study at (at least) two higher education institutions and receive upon completion of the study program a separate degree certificate from each of the participating institutions.

Double degrees appear to be much more common than joint degrees. According to a recent report [2], 26% of European institutions offer joint

degrees, and 76% offer double degrees. About half of the European institutions offer joint and double degrees in the field of business and management; the second most common academic discipline was engineering, with 29% of EU analyzed institutions.

3. WORKING GROUP B – ACTIVITY

The first meeting of the working group related to Theme B took place during the Second EUCEET III General Assembly in Warsaw (23-24 October 2008), on Friday 24 October 2008. Participants freely joined the working group, leading to the following attendance list:

Country	Name	Institution
BE	Jean Berlamont	Katholieke Universiteit Leuven
CZ	Vaclav Kuraz	Czech Technical University Prague
DE	Carsten Ahrens	Fachhochschule Oldenburg
DK	Jacob Steen Moller	Denmark University of Technology Lingby
FR	Thibaut Skrzypek	Ecole National des Ponts et Chaussées Paris
FR	Richard Kastner	Institut National des Science Appliquées de Lyon
FR	Le Tallec Bernard	Institut Superieur du Batiment et des Travaux Public Marseille
FR	Fabrice Emeriault	Institut National des Science Appliquées de Lyon
GR	Constantine Papatheodorou	Technological Educational Institute of Serres
GR	Stephanos Dritsos	University of Patras
HL	Ellen Touw	Delft University of Technology of Netherlands
HU	Aniko Csebfalvi	Janus Pannonius University Pecs
LV	Juris Smirnovs	Technical University Riga
PL	Marta Kosior	Bialystok Technical University
PL	Piotr Berkowski	Wroclaw University of Technology
PT	Ryszard Kowalczyk	University of Beira Interior Covilha
RO	Iacint Manoliu	Technical University of Civil Engineering Bucharest
RO	Irina Lungu	"Gheorghe Asachi" Technical University Iasi
RO	Doina Verdes	Technical University Cluj-Napoca
TR	Ozgur Yaman	Middle East Technical University Ankara

After the foundation of the Working Group in Warsaw, communication between members were established by e-mail.

Within the Theme "*Enhancement of the cooperation between civil engineering faculties in Europe by the development of joint degrees (Double Diploma)"* a Workshop was held in Timisoara on 5th June 2009, being attended by the representatives of the host institution (University "Politecnica" Timisoara) and of the Technical University of Civil Engineering Bucharest and of the Technical University "Gheorghe Asachi" Iasi. Guidelines for a double diploma programme in civil engineering to involve EUCEET members, based

on the experience of the programme developed by the Technical University Munich and University "Politecnica" Timisoara, were discussed.

Information on the activity of the Working Group B and discussions on the joint degree programmes were on the agenda of all meetings of the Management Committee which took place between the General Assemblies in Warsaw and Paris:

- Barcelona (6 February 2009);
- Edinburgh (19 June 2009);
- Zilina (26 October 2009)

The final meeting of the Working Group B, scheduled on 19th November 2009 during the last EUCEET III General Assembly in Paris, was attended by:

Country	Name	Institution
BG	Kosta MLADENOV	University of Architecture, Civil Engineers and Geodesy Sofia
CY	Nicos NEOCLEOUS	Civil Engineering Associations Cyprus
CZ	Josef MACHACEK	Czech Technical University Prague
CZ	Vaclav KURAZ	Czech Technical University Prague
DE	Carsten AHRENS	Fachhochschule Oldenburg,
DK	Cristian FRIER	Aalborg University
FI	Juha PAAVOLA	Helsinki University of Technology
FR	Richard KASTNER	Institut National des Science Appliquées de Lyon
FR	Bernard LE TALLEC	Institut Superieur du Batiment et des Travaux Public Marseille
FR	Georges PILOT	National Council of Engineers and Scientists in France
FR	Francois G. BARON	National Council of Engineers and Scientists in France
GR	Stephanos DRITSOS	University of Patras
GR	Constantine PAPATHEODOROU	Technological Educational Institute Serres
GR	Pericles LATINOPOULOS	Aristotle University Thessaloniky
GR	Errikos MOURATIDIS	Technological Educational Institute Serres
HU	Aniko CSEBFALVI	Janus Pannonius University Pecs
HU	Gyorgy FARKAS	Budapest University of Technology and Economics
HU	Antal LOVAS	Budapest University of Technology and Economics
IT	Diego LO PRESTI	University of Pisa
LT	Vincentas STRAGIS	Vilnius Gediminas Technical University
NL	Ellen TAUW	Delft University of Technology

Country	Name	Institution
PL	Anderj LAPKO	Bialystok Technical University
PT	Fernando BRANCO	High Technical Institute of Lisbon
RO	Iacint MANOLIU	Technical University of Civil Engineering Bucharest
RO	Daniela PREDA	Technical University of Civil Engineering Bucharest
RO	Johan NEUNER	Technical University of Civil Engineering Bucharest
RO	Radu BANCILA	University "Politecnica" Timisoara
RO	Doina VERDES	Technical Univeristy Cluj Napoca
SK	Josef DICKY	Slovak University of Technology Bratislava
SL	Stojan KRAVANJA	University of Maribor
TR	Cenk ARHAN	Istanbul University
UK	Ian MAY	Heriot-Watt University
UK	David Lloyd SMITH	Imperial College London

In the beginning of the Working Group meeting, the chairman made a brief presentation of the activities performed since the foundation of the Working Group. Hereinafter, the chairman presented the draft of the Report for the Theme B, asking for suggestions regarding its content, before the last presentation scheduled during the General Assembly.

Some further clarifications were asked by the participants, especially concerning the extent of the network, the recruitment of students, the assurance of adequate funding, language and sustainability of the program. The slide version of the final Report was presented on 20th of November 2009 in the General Assembly of EUCEET III.

4. JOINT AND DOUBLE DEGREES IN ENGINEERING PROGRAMMMES ACROSS EUROPE

There is a multitude of joint and double degrees in engineering programmmes in the European Universities. In the following, some of them are presented.

TIME (**T**op **I**ndustrial **M**anagers for **E**urope) is a European network of leading Engineering Schools, which has the aim to train high-potential graduates for the future demand of industrial leading-positions. The TIME network was created in 1989 at Ecole Centrale Paris, a leading French Grande Ecole with 16 founding members. Currently, the network has 46 members from 20 different countries.

As founder of the TIME network, the Ecole Centrale Paris welcomes each year over 100 TIME-Students. When a student is arriving at the ECP he has

already successfully completed at least two years of studies at his/her home university and will start together with the French students the "*tronc commun"*. The "*tronc commun"* includes the first two years of studies at ECP in order to obtain deeper knowledge not only in engineering related fields, but also in soft-skills. Besides Physics, Mathematics, Mechanics and Quantum Mechanics, the ECP offers also human and social science courses. A TIME student will study in total between 5 and 6 years and will be rewarded with a Master's level Double Degree from two different institutions. During the education at 2 universities, he will receive a bilingual and diverse in-depth education in engineering, which gives wide-range knowledge to meet the requirements for leading-positions in various fields around the world.

In comparison to other exchange programmes, the TIME programme is designed on a long-term basis (2 years studies abroad). The distinctive features and advantages of the TIME programme were summarized by Simon DAVIES (École Centrale de Lille) [3]:

- **"Adaptability":** students who participate in this programme, can be seen as flexible and open-minded in their approach. They have spent a considerable amount of time in a different country - from their own - and have thus integrated new working practices and approaches to problems;
- **"Cosmopolitan":** about one third of the students who participate in the TIME programmes, returns to their home country; about one third remains in their host country, and the remaining third moves elsewhere. This latter third is slowly increasing;
- **"Linguistic competence":** a TIME exchange can almost be seen as a free language course. Such a programme allows the acquisition of a new language skill (which is not necessarily English) which would normally require expensive language courses;
- **"Set apart":** TIME students can be set apart from the norm; for a potential employer they have qualities that set them apart from other candidates of a similar level of qualification.

Particularities:

- Language of instruction is generally the same language for everybody. In the beginning the courses can be in English (especially in smaller countries with languages not often spoken outside that state). But learning the language should be seen as an asset.
- Student has to stay at least 1.5 years abroad, normal duration would be 2 years.
- 360 ECTS credits are needed to earn the TIME double degree (60 ECTS = 1 year prolongation).

One of the advantages of TIME for the universities is that the University doesn't lose his students. The student should come back after his stay in the partner institution and perhaps stay for a PhD.

There are some other models in this direction. In March 2001, the Technical University of Civil Engineering Bucharest concluded with École Nationale des Ponts et Chaussées, Paris, a ***Double-Diploma*** agreement. Each partner university recognises and gives credit for all or part of studies done in the other university. Students who successfully complete the double-degree programme and satisfy all requirements set by the home and partner institution are simultaneously awarded a degree in the home university as well as the equivalent degree in the partner institution. An international student admitted to a double-degree programme in France spends at least two years of study there at the French partner institution. In the École des Ponts curriculum, the last two years of study are equivalent to a Master's Degree. International students in the double-degree programme complete this two-year Master's Degree. As a general rule, international students coming from universities where the engineering degree is awarded after five years of study are admitted at ENPC at the level Bac+4. However, if the home institutions offers a fist degree programme of 4-year duration, as is the case nowadays with the Technical University of Civil Engineering Bucharest, the student will be admitted at ENPC at the level of Bac+4 only after graduating the first degree programme and after being admitted for the second degree programme at the home institution. Then, completing two years of study he/she receives the diploma of ENPC (equivalent to a MsC diploma) and returns for one semester at TUCEB to complete there the Master programme. To get, thus, three diplomas (first degree diploma in Bucharest, Engineering Diploma at ENPC and Master diploma at TUCEB), student has to study one more year as compared to the student who is not participating in the Double Diploma scheme .

Since 2002, the *École Centrale de Lille* (*EC Lille*), in France and the *Faculté Polytechnique de Mons* (*FPMs*), in Belgium, have a program of dual diplomas where the students of engineering at *EC Lille* and the students of architectural engineering at *FPMs* receive the diploma of engineer of *EC Lille* and the diploma of architect engineer of *FPMs* after having completed the respective course work of their school of origin and a program of studies in the other school. The program results have more than exceeded the founders expectations. It is interesting to mention that, beginning with 2005, the program has received some modifications, mainly in function of students feedback. The curriculum structure of each field had to undergo some modifications as a result of the program's learning accumulations: the civil engineering course had to become more humanistic and systemic while that of architect/urban planning had to become more technological and attentive to the aspects of the economy. The objective is to produce graduates from the two schools who will become

more and more involved as agents of technological, economical, political and socio-environmental change.

Another example of cooperation is **CLUSTER (C**onsortium **L**inking **U**niversities of **S**cience and **T**echnology for **E**ducation and **R**esearch**),** a network of leading European Universities of Technology, founded in 1990, which may be considered as a multi-location European University for Science and Technology. **CLUSTER** is fully committed to the development of the European higher education area. Rectors of CLUSTER have signed the "Convention on mutual recognition of titles" stating that students from other **CLUSTER** institutions will be admitted like local students to master and PhD programmes. This enables vertical mobility for students of all member universities and creates transparency between the engineering programmes. MSc is a prime goal in education for CLUSTER universities. To further strengthen the European dimension at the MSc level, CLUSTER is engaged in developing Dual Degree Programmes. Students enrolled in a MSc programme at a CLUSTER university will have the opportunity to study the second year at another CLUSTER university. They will receive two degrees or a joint degree and be awarded a CLUSTER MSc diploma signed by the representatives of each university. CLUSTER is enabling the professional development of the administrative staff, researchers and teachers through mobility programmes and CLUSTER chairs. Cooperation at the Grants Office level is adding another dimension to the integration of CLUSTER universities. Engineering education and research must respond to the challenge of globalization. The engineer of the future will operate in an entirely new context. In response to a changing world, CLUSTER is engaged in the development of joint programmes with its associate members outside Europe. At the moment, four institutions contribute to the global set of activities of CLUSTER: Tomsk Polytechnic University, Tsinghua University Beijing, Georgia Tech in Atlanta and École Polytechnique de Montreal. The role of CLUSTER, initially envisioned as a facilitator to student and faculty mobility, is changing character to become *a network of excellence*, providing a platform for joint cooperation at all levels. The development of Europe towards a knowledge society, as emphasized in the Lisbon agenda, requires centers of excellence in education, research and innovation. One of the principal advantages for the CLUSTER students is the fact that they have the opportunity to choose among Master and PhD programmes in 11 universities. The university network CLUSTER has the potential to become an important part of the Lisbon strategy and beyond and challenged itself to play a leading role in education, research and innovation at the European level [4].

5 A CASE STUDY: THE MODEL TUM / UPT

In 1991 at the Faculty for Civil Engineering of the "POLITEHNICA" University of Timisoara, it was decided to open a section for a civil engineering 5-year programme taught in German. The reasons behind the decision were:

- Timisoara, the main cultural and industrial centre in western Romania, has always been influenced by the German science and technology;
- the German language is commonly spoken in the area.

This German branch, which was open in the academic year 1991 – 1992, is functioning in parallel with the Romanian one. The number of students is 35 – 50 students in one year, in total there are about 140 students.

In 1993, a cooperation agreement was signed with the Technical University from Munich, Germany. It includes a paragraph stating the contribution of the Technical University from Munich in the consolidation of the German branch in Timisoara. The first 11 civil engineers graduated the German branch in 1996.

Regular exchanges with universities from the German speaking countries took place.

In 2009, the 13th promotion of engineers has sustained the diploma examination. The graduates are very well received by the German companies working in Romania. More than 90 % of them are working in Romania. A high proficiency of the German language and the knowledge in Civil Engineering lead to the direct access to advanced technology, making possible the transfer of technical information to our country.

In 2005, after more than ten years of cooperation, the President of the Technical University of Munich – Prof. Dr. h. c. Wolfgang Herrmann - and the Rector of the University "Politehnica Timişoara – Prof. Dr. Ing. Nicolae Robu – signed, in the context of the internationalization strategy of both universities, an addendum to the existing agreement, concerning the double diploma offered to the students of both universities.

The present system at the "Politehnica" University Timisoara, for the first two cycles, is the following:

- Bachelor - 4 years (8 semesters)
- Master - 2 years (4 semesters).

At T.U. Munich, the two cycles are:

- Bachelor - 3 years (6 semesters)
- Master - 2 years (4 semesters).

Considering this situation, the following schedule was adopted:

- 1,5 years (3 Semesters) – Timişoara
- 1,5 years (3 Semesters) – Munich
  ➔ Bachelor TU Munich
- 1 year (2 Semesters) – Timişoara
  ➔ Bachelor UP Timişoara

The possibilities for the Master degree are open; the title can be acquired in Timisoara or in Munich.

The double diploma programme is accessible only for the best students. In March 2007 the first four students from Timisoara began their studies in Munich after three semesters in Timisoara, enjoying the generous support of the Bayerische Bauindustrie which offered scholarships to the students.

Some difficulties were encountered, like the adaptation of the Romanian students to another system, problems in the schedule (there are two months difference between the academic year in Timisoara and in Munich), the recognition by some professors of some exams at the home university and at the host university (different curricula). The language was not a problem.

Two diplomas are delivered: a bachelor degree from the Technical University in Munich (3 years) and a bachelora (engineering) degree from the University "POLITEHNICA" in Timisoara (4 years). This gives the graduates a nationally recognized diploma in both countries. The success of this concept is acknowledged by the industry. Important companies are favourable impressed and show interest in recruiting engineers with dual qualification. An extension of this program with other Universities, like Technical Universities from Vienna and Graz, is under study. It was largely "*learning by doing*" and it goes easier and easier every time.

The program is accessible, in a first step, only for the best students (elite). Nevertheless, the double diploma programme is becoming very popular among students. Also it is important to mention that practical placements at different companies in Bavaria is assured.
In the near future, due to large perspectives offered by the construction market in Romania, it is possible that also students from Germany would be interested in this program.

6. WORKING GROUP B – QUESTIONNAIRE

The problem of a joint degree – double diploma was tackled successively in the EUCEET meetings and raised many discussions "pro and contra". In order to have an overview about the different existing opinions, a questionnaire was distributed to the EUCEET partners, structured as follows:

1. Do you have an English Civil Engineering branch in your University?
2. Do you agree to enter in a joint degree (pilot) network in Civil Engineering?
3. Which system do you have
   - Bachelor with 180 ECTS
   - Bachelor with 240 ECTS
4. Do you agree the number of max. 10 % of students proposed for the double diploma ?
5. Do you agree to the elaboration in the frame of EUCEET of rules and guidelines for the joint degree network?
6. Do you agree the above proposed scheme for a joint degree? Observations?
7. Do you agree on the following conditions:
   - 7.1 Jointly developed programmes
   - 7.1 Cooperation in admission and examination of students
   - 7.2 Staff and teacher mobility
8. Do you agree to sign an agreement confirming the educational goals and content of the programme, providing different organization details?
9. If you enter in the double (joint) degree programme do you agree with the following proposals:
   - 9.1 elaboration of a dedicated handbook and website
   - 9.2 nomination of a coordinator giving information and support, developing initiatives, organizing meetings and events
   - 9.3 communication organized via the website
   - 9.4 solutions for scholarships and awards for double degrees students.
10. Which other observations do you have concerning the joint degree?

The results are presented in the table below.

	Question	Cz TU Prague	Univ. Zilina	BUTE	Bialystok T.U.	Istanbul Univ.	Delft U.T.	ENPC
1	**Civil eng. Branch**	Yes	Yes	Yes	Possible	No	Yes MSc	No
2	**Agree**	Prefer D.D. for MSc	Yes	Yes	Yes	Yes (language barrier)	No	Yes
3	**ECTS**	240	180 240	240	210	180 240	180	
4	**10% students**	<10%	Yes	Yes	Yes	Yes	?	Yes
5	**Rules % guidelines**	Yes also D.D.	Yes	Yes	Yes	Yes	Models-yes Rules-no	
6	**Scheme 4 -> 3 …**	Yes	Yes	Yes	Host shorter than home	Yes	No for bachelor	
7.1	**Jointly progr.**	D.D.	Yes	Yes	Yes	Yes	Yes	
7.2	**Coop. adm. stud.**	Yes	Yes	Yes	Yes	Specific in Turkey	Yes	
7.3	**Staff & teacher mobility**	Yes	Yes	Yes	Yes	Yes	Yes	
8	**Agree-ment**	Yes	Yes	Yes	Yes	Compli-cated procedure	Only with indiv. partners	
9.1	**Hand-book & web**	Yes	Yes	Yes	Yes	To be dis-cussed	No	
9.2	**Coordina -tor**	Yes	Yes	Yes	Yes		No	
9.3	**Commu-nication web**	Yes	Yes	Yes	Yes	To be discussed	No	
9.4	**Scholar-ship**	Yes	Yes	Yes	Yes	To be dis-cussed	No	
10	**Observa-tions**	Prefer D.D. for MSc	-	Prefer D.D. for MSc	Educat. Differ. Compar	-	Only in MSc	

As it can be seen, the general opinion is for this concept, even if many participants have this option only for the level of "Master". Meanwhile, other Universities (like the University of Architecture, Civil Engineers and Geodesy from Sofia, the University from Pecs etc.) had shown their interest in the idea!

7. WORKING GROUP B – PROPOSALS

In order to qualify for a diploma from the host University, students must satisfy all the graduation requirements of this institution. This implies the recognition of a part of the studies they have completed in their home University. Other general conditions, problems and recommendations are:

- Financial problems; University budgets are tight. Scholarships and personal efforts are important.
- Despite different educational systems, a common curricula is very helpful.
- Exchange semesters; usually half of the studies must be completed to the partner University.
- Application documents; each institution will provide documents for its partner. These documents will be based on the European Credit Transfer System:
    - application form for the student
    - learning agreement
    - transcript of record.
- Teaching language; both institutions may offer a study program in an international language, for example English, but it can be also French, German etc.
- Tuition fees and insurance; students participating in an exchange program continue to pay these fees – if they exist - at their home University. It is recommendable that no fees are paid to the host University. An insurance paper covering individual responsibility and medical insurance for the visiting student is necessary.
- Throughout the study period in the host establishment, the visiting student is subjected to administrative and academic regulations of the host institution.
- Validation of studies; the host University will send to the home institution details of the grades obtained by the exchange students and will indicate if the student has satisfactorily completed all the study semesters required. Students who validate all their study semesters in the host institution obtain the double diploma.
- Finally a student who fulfils all the conditions for the double diploma will receive a diploma from each of the two Universities.
- Harmonization of the scheduling problems; in many universities the beginning of the academic year is different.
- Regular communication between the Universities and with the exchange students.

Without additional funding for a coordinator or program assistant, it will be difficult to meet the additional workload that joint or double degree programs usually generate. Personal efforts and engagement is often the starting point of a

joint or double degree program, but without institutional support at all levels, most such initiatives will be short lived.

A very important problem is the candidates selection. The recommendation is to select only good students ready to make additional efforts. Adequate language knowledge is compulsory.

Proposal: Taking the model of the TIME, we propose a similar **network in the field of Civil Engineering in the frame of EUCEET**. The graduate of this network will study in total between 4 and 6 years and will be rewarded with a Double Degree from two different countries. In a first step we propose this network at the Bachelor level; it can be extended also to the Master level.

In what follows, one can find a scheme with the diverse possibilities for a double degree, taking into account the different systems for the first cycle degree (three or four years):

Double (Joint) degree scheme for bachelor:

A. Between the Universities which have the system of 4 years – bachelor (240 ECTS)

- Two years (120 ECTS) at the home University
- Two years (120 ECTS) at the host University
  When the student has passed all the exams (decided together with an Academic Advisor), the final project will be presented to an official Committee, recognised in both Universities at the same time.

B. Between the Universities which have the system of 3 years – bachelor (180 ECTS)

- 1,5 years (90 ECTS) at the home University
- 1,5 years (90 ECTS) at the host University
  When the student has passed all the exams (decided together with an Academic Advisor), the final project will be presented to an official Committee, recognised in both Universities at the same time.

C. Between the one University of 3 years and another of 4 years

C1. From 4 years (home University) to 3 years (host University)

- 1,5 years (90 ECTS) at the home University
- 1,5 years (90 ECTS) at the host University

Diploma examination – bachelor degree with 180 ECTS (host University)

- 1,0 years (60 ECTS) at the home University

Diploma is recognized – bachelor degree with 240 ECTS (home University)

C2. From 3 years (home University) to 4 years (host University)

- 1 year (60 ECTS) at the home University

- 1 year (60 ECTS) at the host University
- 1 year (60 ECTS) at the home University

Diploma examination – bachelor degree with 180 ECTS (home University)

- 1,0 years (60 ECTS) at the host University

Diploma is recognized – bachelor degree with 240 ECTS (host University)

D. Between the Universities which maintained integrated – 5 year - programmes. A specific rule, based on the experience of Double Diploma agreements concluded by Ecole Nationale des Ponts et Chaussées will be established.

One of the most important conditions for entering in the network is the existence of a teaching branch in a European language. In Romania in Civil Engineering in English is teached – parallel to the education in Romanian - in Bucharest, Iasi and Timisoara. A short presentation of the Civil Engineering - English Teaching Branch from Timisoara is presented below:

THE "POLITEHNICA" UNIVERSITY OF TIMISOARA - ROMANIA

Civil Engineering Faculty

Civil Engineering: English Teaching Branch (founded 1991)

Duration of study & graduates:

- **Duration of study (until 2009) = 5 years**
- **Duration of study (from 2009) = 4 years**
- **Optional: Master course in English with a duration of 2 years (4 semesters)**
- **Number of graduation series = 14**
- **First graduation(5 years system) = 1996**
- **First graduation (4 years system) = 2009**
- **Average number of graduates = 15/year**
- **Total number of graduates = cca. 210**

The network can be created step by step on the base of bilateral agreements. An informative model is presented in the Annex I.

8. CONCLUSIONS

An evaluation of the current situation of joint and double degree programs and the identification of challenges and opportunities with the aim to expand existing programs or to or develop new ones in the frame of the EUCEET Association, was performed.

In European countries the introduction of joint and double degree programs has been a part of internationalization strategies in higher education, helping to create stronger links and enlarging institutional partnerships, as well as preparing students for a global workplace. In an increasingly global and competitive higher education market, collaborative programmes of this kind, can offer a set of advantages and are an important asset in the competition for attracting the best students.

Finally, some general aspects can be pointed out:

- The key motivations for launching joint and double degree programs are internationalization strategies in higher education and acquiring international visibility and prestige of the university,
- Some EU universities launched their first joint and double degree programs prior to 1996;
- Due to legal issues, double degrees programs appear to be more common than joint degrees;
- Each and every collaborative degree program is unique;
- European institutions are more inclined to offer joint and double degrees at the master level;
- English is by far the most commonly used language of instruction, followed by French, Spanish, German and Italian;
- Adequate financial support and sustainability of the program are important;
- A large number of EU institutions plan to develop in the future more joint and double degrees;
- A clear legal framework upon which to build these programs - including accreditation guidelines – is in the near future also necessary.

Partner institutions can be selected on the basis of existing institutional links developed within EUCEET.

Students who participate in these exchanges benefit from a widening of their knowledge. A double diploma in civil engineering, can be obtained in most cases without additional study periods.

REFERENCES

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[2] Matthias Kuder, Freie Universität Berlin, Daniel Obst, Institute of International Education **„Joint and Double Degree Programs in the Transatlantic Context: a Survey Report"** Project funded by the EU-U.S. Atlantis Program of the U.S. Department of Education's Fund for the Improvement of Postsecondary Education (FIPSE) and the European Commission's Directorate General for Education and Culture, January 2009, www.iienetwork.org/file_depot

[3] T.I.M.E. General Assembly, Valencia 16-17thOctober 2008,Workshop: "The T.I.M.E. Double Degree and the Bologna Process"Report by Simon DAVIES - École Centrale de Lille

[4] CLUSTER – From integrated Engineering Diploma to Dual and Joint Degree Programmes, A survey of Cluster University Engineering Education, Prof. Ramon Wyss, General Secretary Cluster.

[5] Smieja, Tomasz, Rudion, Krzysztof, et al: "Diploma Project: a new higher education concept in a United Europe, The International Journal of Electrical Engineering Education, Apr 2007"

Annex I

COOPERATION AGREEMENT
between
xy,
with its legal domicile at xy
represented by its xy
and
The Faculty of Civil Engineering, Universitatea "POLITEHNICA" from Timişoara
with its legal domicile at P-ta Victoriei 1, Timisoara,
represented by its Rector, Prof. Dr. Ing. Nicolae ROBU

Both parties, members of the **EUCEET** (*European Civil Engineering Education and Training*) Association, have reached the following agreement:

Article 1: **Objectives**

The present contract provides the framework for common action to be taken between the above - mentioned partners. The aim is to promote the exchange of:

- persons,
- experience and projects in the area of higher education and research, especially for the graduate double degree (double diploma) programme.

Article 2: **Nature of the Exchange**

The contract shall promote

- the exchange of students, professors and researchers,
- the exchange of information and scientific publications,
- the exchange of students for visits to and internships in companies,
- meeting for study purposes as well as joint seminars on previously agreed upon topics.

The exchange of persons shall comply with the regulations and procedures in force at both institutions.

No study fees will be charged by the receiving university.

Article 3: **Education**

The EUCEET Graduate Double Degree Programme

The two parties to the contract shall agree to promote the exchange of students for the attainment of a graduate double degree in accordance with the policy of the EUCEET Association and regulated by special agreements set out in addenda.

Both parties shall endeavor to provide financial support for the student exchange programme and help with finding accommodation.

Both parties shall be responsible for making certain that their students are fully informed of the possibilities for exchange. To this end, the parties shall agree to exchange the required documents in order to inform their students about the study programmes at the partner institution.

The EUCEET Master Joint Degree Programme

Both parties shall moreover promote the establishment of EUCEET Master joint degree programmes in accordance with the regulations of the EUCEET Association and cooperate in marketing these programmes abroad.

Article 4: **Research**

Both parties shall endeavor to promote research cooperation by encouraging exchange and discussion of scientific methods and potential joint research applications. The exchange of doctoral candidates will also be encouraged.

Article 5: **Organisation and Procedure**

Each party shall appoint a representative responsible for realizing the objectives indicated in this agreement.

Each party shall provide advice to the other party whenever it is deemed necessary. Both parties will meet at least once a year to discuss further developments and take stock of achievements.

Article 6: **Duration**

The present contract shall come into force when it is signed by both contracting parties.

It will remain valid for five years and can be renewed after verification of the activities developed during its duration and provided that the two parties agree on renewal.

The present contract may be modified by either party in agreement with the other party.

The present agreement may be cancelled by either of the two parties with six months' notice. In this case, the contract shall continue to be valid for any professors and students who may still be participating in the programme.

The parties agree to solve in a friendly manner any controversy arising from the interpretation of the present agreement. If agreement cannot be reached, the claim will be submitted for arbitration. Each party will appoint a member for an arbitration panel, and one member will be chosen by mutual consent.

Article 7: **Obligations**

No financial obligations for either party shall arise out of this agreement.

Article 8: **Addenda**

Special agreements may be defined in addenda.

The present agreement shall be prepared in x copies, all of which shall have equal validity.

XXX, on XXX	Timisoara, on **XXX**
for ……	for Universitatea « POLITEHNICA » Timisoara
Rector	Rector
_ _ _ _ _ _ _ _ _ _ _ _ _ _	Prof. Dr. Ing. Nicolae ROBU

THEME D: Best practice in establishing and running multi-disciplinary programmes of education, involving civil engineering and other fields

Report of the
Working Group

THEME D: BEST PRACTICE IN ESTABLISHING AND RUNNING MULTI-DISCIPLINARY PROGRAMMES OF EDUCATION, INVOLVING CIVIL ENGINEERING AND OTHER FIELDS

Report of Working Group
Tudor BUGNARIU[1]

1. FOREWORD

The nowadays demands of the labor market persuade for widened competences of the graduates of higher education. The technological development and the necessity of management performance in all fields of activity entailed a new approach for higher education institutions in establishing their teaching curricula, by providing multidisciplinary teaching and research programmes. The main goals are to enhance the graduate's aptitudes and to improve their communication skills, working in interdisciplinary teams.

At least the following objective situations in which multidisciplinary programmes are brought to existence can be notice:

- joining within the curriculum of tuition and research fields which usually are completely separated, but whose common activity is indispensable (compulsory) for development; for example, it is the case of joining medicine, biological and biomedical sciences, with new technologies of investigation, diagnosis and treatment, based on competences in IT, computer science, fine mechanics, optics, etc;
- the emergence of new professions on the labor market, especially in management activities and public administration; it is of course an opportunity for higher education institutions to enhance their attractiveness facing the candidates, by providing multidisciplinary programmes related to these professions.

EUCEET III planned to analyze the subject of multidisciplinary studies promoted among European civil engineering universities. According to the *Terms of References* of EUCEET III:

- The development of inter and multidisciplinary programmes is a challenge of higher engineering education.

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[1] Chairman of the Working Group for the Theme D;
Prof. Dr. at Technical University of Civil Engineering Bucharest, Romania

- Due to its broadness and complexity, civil engineering is interacting with other fields, such as economy, architecture, building sciences, geosciences, informatics etc. As a natural consequence, educational programmes were developed, at both undergraduate and post-graduate level, including lifelong learning type of programmes.
- It is good time to survey and disseminate best practice in this domain and to promote creation of such programmes by EUCEET partner institutions, with emphasis on programmes linking economics and civil engineering.

We intend to draw some conclusions on how the EUCEET III partners appreciate the opportunity and the dissemination of such degree programmes and their opinion about how they can be developed in the future.

2. INTER/MULTIDISCIPLINARY PROGRAMMES AMONG TECHNICAL HIGHER EDUCATION (web sites and articles)

Before commenting the activity assumed by the working group it was interesting to analyze the topic of multidisciplinary study programmes among technical higher education in general. The following remarks and ideas are boned up a few papers dealing with the subject and web pages posted by universities providing such degree programmes.

The initiative of multidisciplinary studies and research programmes is for sure widespread among higher education. Most favorable opinions are, of course, expressed by those institutions or authors providing or involved in this activity, but, as it was stated before, in some circumstances they became indispensable. It is the case of those programmes based on specific teaching and research subjects, bonded to immediate necessities of a peculiar domain. Most case studies emphasize the advantages of implementing the system, nevertheless the main shortcomings and difficulties encountered in practice. The major advantages usually refer to the augmentation of competences, experience and professional practice of graduates, broadening their area of knowledge. In most cases the most important problem is that of provisioning the resources.

Consenting with the idea of learning through experience, students working in multidisciplinary projects will have a better opportunity to develop generic and specific skills. Moreover, if such projects concern and involve community representatives, a two-way interaction may occur, defining a “scholarship of engagement”, with mutual benefits for students, university and the community they are part off [1]. Such programs provide also a better framework for student-oriented activities, enhancing their final skills and competences, which are relevant to professional practice, a greater knowledge of significant research, or a larger perspective over multicultural issues. Working in

multidisciplinary teams also improves the learning process itself, by enhancing the students' interest due to curiosity and motivation aroused by experience.

The benefits are out of question for all components of the partnership: students, teaching staff and labor market. Concerning the cost of such an approach, the main finding refers to the augmentation of the allocated staff resources.

The aim of this type of programmes is also to encourage an interdisciplinary and multidisciplinary environment, focused on the development of multilevel communication skills. The development of the global job market in the near future renders evident the decreasing perception of gaps between science and engineering. Due to the integration of various specializations, competences and skills, the future technologies will enjoin the ability of graduates to use a common communication language. The role of multidisciplinary engineering education can be significant in the formation of these communication skills [2]. New curricular initiatives as those for "Bio-nano Science and Engineering" or "Health Monitoring – for Structures, Systems and People" programmes, lead to new generation of graduates who are familiar with the engineering, biomedical and life sciences.

Engineering Science graduates should be also prepared for non-technical but equally important issues foreseen to be present in their working life, as environmental, sustainability, ethical, social and political aspects. Because the engineering profession is usually practiced in multidisciplinary teams, involving the management of people, time and resources, it's time to emphasize the value of multidisciplinary engineering education and research and to embrace new sciences for engineering integration

As difficulty, new curricular changes and developments are necessary, without sacrificing their main content and scientific rigor.

In order to achieve a complete technical education, engineers should be also trained in non-technical areas. There are opinions suggesting that, to enhance technical education, some actual shortcomings of the academic curricula need to be revised, training scientists and engineers in technical subjects being not longer enough. Similarly, students in non-technical domains as business and law should be able to understand the technological support, evolution and background of their activity. Multidisciplinary education can become the opportunity to improve the understanding of economic and legal aspects of science and engineering.

While narrow, specialized education is important for providing essential skills, the employees are also expected to cope with a variety of topics outside their basic domain. It seems that the target of multidisciplinary programmes is to make the transition from discipline-oriented research to market-driven research. The way in which such programmes will influence future careers of graduates is, and will be, a matter to be analysed.

In the global market, the traditional difference between various specializations becomes more and more blurry. Analists ascertain that the employment demands are changing from narrow, single specialized skills and competences to a much larger variety of topics requested from the graduate candidates. Higher education institutions should provide, by their degree programmes, the right set of skills for future employees. For graduate students not only fundamental skills should be taught, but also that knowledge widening their perspective for those multidisciplinary aspects which are essential for improving their careers.

Looking for the subject, a broad variety of multidisciplinary programme types are provided by higher education institutions. They are ranging from small group projects, covered by a single course, to long term degree programmes awarding BSc, MSc or PhD titles. Most of the small programmes are grouping students from various sciences and engineering disciplines into specific research projects, in order to improve their ability in teamwork, communication and management skills [3]. One can notice the growing number of joint degree programmes, designed to provide a more evenly balanced education in engineering, management or legal aspects of existing technologies.

Thereby, it looks like in many domains of engineering studies multidisciplinary programmes are highly promoted. However, most of them are organized at postgraduate level, the main fields being joined together according to peculiar research projects, entailed either by opportunities of the job market or by the technological development programmes.

3. WORKING GROUP D – ACTIVITY

The first meeting of the working group related to Theme D took place during the Second EUCEET III General Assembly in Warsaw (23-24 October 2008), on Friday 24 October 2008. Participants freely joined the working group, leading to the following attendance list:

Ozgur YAMAN	**METU Istambul**	**TR**
Thibaut SKRZYPEK	**ENPC Paris**	**FR**
Fabrice EMERIAULT	**INSA Lyon**	**FR**
Marta KOSIOR	**BTU Bialystok**	**PL**
Piotr BALOUSKI	**WUT Warsaw**	**PL**
Iacint MANOLIU	**TUCE Bucharest**	**RO**
Stephanos DRITSOS	**UP Patras**	**GR**
Constantine PAPATHEODOROU	**TEI Seres**	**GR**
Irina LUNGU	**TUI Iasi**	**RO**
Carsten AHRENS	**FH OOW Oldenburg**	**DE**
Aniko CSEBFALV	**UP Pecs**	**HU**

Ellen TAUW	**DUT Delft**	**NL**
Vaclav KURAZ	**CTU Prague**	**CZ**
Tudor BUGNARIU	**TUCE Bucharest**	**RO**

No other meeting of the working group members was scheduled until the final General Assembly in Paris, future communication being foreseen by e-mail.

After presenting the aim of the meeting, according to the Terms of References of EUCEET III, the chairman of the working group initiated discussions based on the following questions:

- Are there interdisciplinary programmes present in the European Civil Engineering Education?

  What institution are providing such degrees and at what education level?
  Which are the fields involved with Civil Engineering in interdisciplinary programmes?
  Do both components have similar weights or one of them is actually the foremost?

- Civil Engineering represents a multidisciplinary topic by its own, fact already proved by the huge number of specializations provided in the second cycle. Where actually starts an evident tear to interdisciplinary programmes and what makes the difference?
- How are such degrees organised? Do they involve several institutions?
- What are the qualifications awarded?
- Which are the perspectives of graduates in the labour/job market?

  Do they have the permission/competence to practice in both fields? Is it more likely that graduates will practice in a domain where both field are involved?

The participants expressed their opinion regarding these issues. After a brief description, some degree programmes delivered by partner institutions were suggested to be framed into the topic. Comments and other suggestions followed.

It was emphasized that the multidisciplinary programmes in discussion should be self-standing, short or long term degrees, Bachelor or Master programmes, awarding their own qualification. Moreover, it was stated as very important, that multidisciplinary programmes should be not confounded with a specialization or a branch of a common degree provided (usually in the last years) by the higher education institution.

There was also highlighted the possibility that inter/multidisciplinary programmes may be the result of cooperation of several institutions and that double-degree diplomas may be awarded.

Closing the meeting, the chairman submitted the idea to carry on, in the following months, a survey among the partner institutions, concerning the main topics of the discussions.

A draft of the questionnaire, sketched by the chairman, was sent to all members of the working group and to Management Committee members, to ask for suggestions. The questionnaire and first answers were presented during the Management Committee meeting in Barcelona, on the 6th of February 2009. No suggestions were made, consequently the questionnaire was sent to representatives of all partner institutions.

A last call for answers was sent before the Management Committee meeting in Edinburgh, on the 9th of June 2009. The results were presented during the Management Committee meeting in Edinburgh.

The second and final meeting of the working group members was scheduled during the last EUCEET III General Assembly in Paris, on 19th of November 2009. Many members of the General Assembly joined the working group, leading to the following attendance list:

Kosta MLADENOV	**UACEG Sofia**	**BG**
Nicos NEOCLEOUS	**Civil Engineering Assoc Cyprus**	**CY**
Vaclav KURAZ	**CTU Prague**	**CZ**
Josef MACHACEK	**CTU Prague**	**CZ**
Cristian FRIER	**Aalborg University**	**DK**
Juha PAAVOLA	**Helsinki UT**	**FI**
Fabrice EMERIAULT	**INSA Lyon**	**FR**
Richard KASTNER	**INSA Lyon**	**FR**
Bernard LE TALLEC	**ISBA France**	**FR**
Georges PILOT	**CNISF France**	**FR**
Francois Gerard BARON	**CNISF France**	**FR**
Stephanos DRITSOS	**UP Patras**	**GR**
Constantine PAPATHEODOROU	**TEI Seres**	**GR**
Pericles LATINOPOULOS	**Aristotle University Saloniky**	**GR**
Errikos MOURATIDIS	**TEI Seres**	**GR**
Aniko CSEBFALVI	**UP Pecs**	**HU**
Gyorgy FARKAS	**Budapest UT**	**HU**
Antal LOVAS	**Budapest UT**	**HU**
Diego LO PRESTI	**University of Pisa**	**IT**

Vincentas STRAGIS	**Vilnius Geminidas TU**	**LT**
Ellen TAUW	**DUT Delft**	**NL**
Anderj LAPKO	**BTU Bialystok**	**PL**
Fernando BRANCO	**IST Lisbon**	**PT**
Iacint MANOLIU	**TUCE Bucharest**	**RO**
Tudor BUGNARIU	**TUCE Bucharest**	**RO**
Daniela PREDA	**TUCE Bucharest**	**RO**
Johan NEUNER	**TUCE Bucharest**	**RO**
Radu BANCILA	**PU Timisoara**	**RO**
Doina VERDES	**TU luj Napoca**	**RO**
Josef DICKY	**SUT Bratislava**	**SK**
Stojan KRAVANJA	**University of Maribor**	**SL**
Cenk ARHAN	**Istambul University**	**TR**
Ian MAY	**Heriot-Watt University**	**UK**
Colin KERR	**Imperial College London**	**UK**

At the beginning of the Working Group meeting, the chairman made a brief presentation of the activities performed throughout the last year. Hereinafter, the chairman presented the draft of the Report of the Working Group - Theme D, asking for any final suggestions regarding its content and conclusions, before the last presentation scheduled during the General Assembly.

Some further clarifications were asked by the participants, especially concerning the opinion of the labour market and the graduates' employability in respect of some multidisciplinary education programmes mentioned among the responses to the questionnaire.

The slide version of the final Report was presented on 20th of November 2009 in the General Assembly of EUCEET III.

The final version of the questionnaire of Theme D in presented in the Annex 1.

4. RESULTS OF THE SURVEY AND COMMENTS

Out o a total number of 16 partner institutions that answered to WG-Theme D questionnaire, only 10 confirmed the organisation of multidisciplinary degree programmes. It should be mentioned that according with the questionnaire completing recommendations, only positive answers where expected.

Without receiving an answer, a research interdisciplinary programme was found on internet, provided by University College Dublin, partner of EUCEET.

The list of received answers is presented in the table printed in landscape on the following page.

The titles of inter/multidisciplinary programmes provided by the respondent institutions, at undergraduate level (U) or postgraduate level (P) are listed below:

CZ	Czech Technical University in Prague	1. Architecture and Civil Engineering (U+P) 2. Safety and Risk Engineering (U) 3. Buildings and Environment (P) 4. Intelligent Buildings (P)
DE	Oldenburg University of Applied Sciences FH OOW	1. European Civil Engineering Management (U) 2. Civil Engineering Management (U) 3. Economics in Civil Engineering (U) 4. Facility Management (P)
DK	Technical University of Denmark, DTU	Architectural Engineering (U + P)
ES	Cantabria University	Master in environmental engineering (P)
FR	Ecole des Ponts ParisTech	1. Structures and architecture (U + P) 2. Introduction to design (U + P) 3. Works and environment (U + P)
IT	University of Pisa	Applied Geophysics (P)
NL	Delft University of Technology	1. Transportation, Infrastructure and Logistics (P) 2. Offshore Engineering (P) 3. Geomatics (P)
PT	University of Porto	1. *Biomedical Engineering* (U + P) 2. *Multimedia Engineering* (P) (joint venture)
RO	Technival University of Civil Engineering Bucharest	1. Civil Engineering - Economics (U+P) 2. Automation and Applied Informatics (U)
SK	University of Žilina	1. Transportation Planning (U) 2. Technology and Construction Management (U) 3. Forensic Engineering (P)

List of respondents

	Country	City	Institution	Respodent	e-mail	MdP
1	**CZ**	Prague	Czech Technical University in Prague	Joseph Machacek	machacek@fsv.cvut.cz	**Y**
2	**DE**	Oldenburg	University of Applied Sciences FH OOW	Carsten Ahrens	carsten.ahrens@fh-oow.de	**Y**
3	**DK**	Lyngby	Technical University of Denmark, DTU	Jacob Steen Møller	jsm@byg.dtu.dk	**Y**
4	**ES**	Santander	Cantabria University	Pedro Serrano	pedro.serrano@unican.es	**Y**
5	**FR**	Marne-la-Vallée	Ecole des Ponts ParisTech	Thibaut Skrzypek	thibaut.skrzypek@encp.fr	**Y**
6	**HU**	Budapest	University of Technology and Economics	Antal Lovas	alovas@mail.bme.hu	**N**
7	**IT**	Pisa	University of Pisa	Diego Lo Presti	d.lopresti@ing.unipi.it	**Y**
8	**IT**	Trento	University of Trento	Riccardo Zandonini	riccardo.zandonini@ing.unitn.it	**N**
9	**LV**	Riga	Riga Technical University	Juris Smirnovs	smirnovs@bf.rtu.lv	**N**
10	**NL**	Delft	Delft University of Technology	Ellen Touw	e.touw@tudelft.nl	**Y**
11	**PT**	Porto	University of Porto	Alfredo Soeiro	soeiro.alfredo@gmail.com	**Y**
12	**RO**	Bucharest	Technival University of Civil Engineering	Daniela Preda	dpreda@utcb.ro	**Y**
				Viorel Marinescu	viorel@utcb.ro	
13	**RO**	Timisoara	Polytechnic University of Timisoara	Radu Bancila	radu.bancila@clicknet.ro	**N**
14	**SK**	Žilina	University of Žilina	Jan Bujnak	rektor@uniza.sk	**Y**
15	**TR**	Istambul	Istanbul University	Feyza Çinicioðlu	feyzac@istanbul.edu.tr	**N**
16	**UK**	London	Imperial College London	Colin Kerr	c.j.kerr@imperial.ac.uk	**N**

Concerning the 1st (starting) year of the provided inter/multidisciplinary programme, the following answers were received. A supplementary question refers to the character of the inter/multidisciplinary programme: if it is provided as a permanent one, every year after beginning (P), or if it is provided temporarily, according to various circumstances (T).

CZ	**CTU**	Architecture and Civil Engineering	2003	P
		Safety and Risk Engineering	2006	
		Buildings and Environment	2003	
		Intelligent Buildings	2006	
DE	**FH OOW**	European Civil Engineering Management	1992	P
		Civil Engineering Management	1998	
		Economics in Civil Engineering	1999	
		Facility Management	2002	
DK	**DTU**	Architectural Engineering	2002	P
ES	**CU**	Master in environmental engineering	2000	P
FR	**EPPT**	Structures and architecture	2006	P
		Introduction to design	2006	
		Works and environment	2007	
IT	**UP**	Applied Geophysics	2004	P
NL	**DUT**	Transportation, Infrastructure and Logistics	2006	P
		Offshore Engineering	2004	
		Geomatics	2005	
PT	**UP**	Biomedical Engineering	2005 (1996)	P
		Multimedia Engineering	2001	
RO	**TUCEB**	Civil Engineering - Economics	1995	P
		Automation and Applied Informatics	2005	
SK	**UŽ**	Transportation Planning	2000	P
		Technology and Construction Management	2003	
		Forensic Engineering	1999	

Concerning the question on to whom belongs initiative for organizing the inter/multidisciplinary programme (faculty level – F, department level – D, university level – U) and the main reasons for providing this type of programme, the following answers were received

CTU	Architecture and Civil Engineering	F/D	request of high school/first degree graduates, **demand of industry**, to attract other students
	Safety and Risk Engineering	F/D	
	Buildings and Environment	F/D	
	Intelligent Buildings	F/D	
FH OOW	European Civil Engineering Management	F/D	**the demand of industry**, setting up a specific profile
	Civil Engineering Management	F/D	
	Economics in Civil Engineering	F/D	
	Facility Management	F/D	
DTU	Architectural Engineering	F/D	proposed by DTU but **endorsed by industry**
CU	Master in environmental engineering	F/D	request of high school/first degree graduates, **the demand of industry**
EPPT	Structures and architecture	F/D*	**the demand of industry**
	Introduction to design		
	Works and environment		
UP	Applied Geophysics	U**	**the demand of industry**
DUT	Transportation, Infrastructure and Logistics	F/D/ U	**the demand of industry**, fields which were not yet covered
	Offshore Engineering		
	Geomatics		
UP	Biomedical Engineering	F/D	**the demand of industry**, other faculties
	Multimedia Engineering		
TUCEB	Civil Engineering – Economics	U	**the demand of industry**
	Automation and Applied Informatics	F/D	**the demand of industry**
UŽ	Transportation Planning	F/D	**the demand of industry**, other faculties
	Technology and Construction Management		
	Forensic Engineering		

* involving other universities
** two universities/double diploma

The next question refers to the admission criteria for the inter/multidisciplinary programmes: if there are peculiar admission criteria (Y) or if they are similar with those requested for other (common) programmes provided by the institution (N). Details concerning the eventual peculiarities were expected.

The following answers were received:

CZ	**CTU**	Architecture and Civil Engineering	Y*
		Safety and Risk Engineering	N
		Buildings and Environment	N
		Intelligent Buildings	N
DE	**FH OOW**	European Civil Engineering Management	N
		Civil Engineering Management	N
		Economics in Civil Engineering	N
		Facility Management	N
DK	**DTU**	Architectural Engineering	N
ES	**CU**	Master in environmental engineering	Y
FR	**EPPT**	Structures and architecture	Y**
		Introduction to design	N
		Works and environment	N
IT	**UP**	Applied Geophysics	Y***
NL	**DUT**	Transportation, Infrastructure and Logistics	N
		Offshore Engineering	
		Geomatics	
PT	**UP**	Biomedical Engineering	Y
		Multimedia Engineering	
RO	**TUCEB**	Civil Engineering - Economics	Y****
		Automation and Applied Informatics	N
SK	**UŽ**	Transportation Planning	N
		Technology and Construction Management	
		Forensic Engineering	

* drawing and aesthetic competences are requested

** open to students coming from schools of architecture

*** the maximum number of enrolled students is yearly fixed and an admission test defines the priority list

**** economics subjects requested for the admission test

Concerning the question if the multi-disciplinary programme follows the same schedule (number of semesters, contact hours, etc.) as other programmes provided by the institution, the following answers were received:

CZ	**CTU**	Architecture and Civil Engineering	N*
		Safety and Risk Engineering	Y
		Buildings and Environment	Y
		Intelligent Buildings	N*
DE	**FH OOW**	European Civil Engineering Management	N
		Civil Engineering Management	N
		Economics in Civil Engineering	N
		Facility Management	N
DK	**DTU**	Architectural Engineering	N
ES	**CU**	Master in environmental engineering	Y
FR	**EPPT**	Structures and architecture	Y**
		Introduction to design	N
		Works and environment	N
IT	**UP**	Applied Geophysics	Y
NL	**DUT**	Transportation, Infrastructure and Logistics	Y
		Offshore Engineering	
		Geomatics	
PT	**UP**	Biomedical Engineering	Y
		Multimedia Engineering	
RO	**TUCEB**	Civil Engineering - Economics	Y
		Automation and Applied Informatics	Y
SK	**UŽ**	Transportation Planning	Y
		Technology and Construction Management	
		Forensic Engineering	

* +1 semester

** + workshops and specific courses

Probably the most significant question refers to the weight of civil engineering subjects in the curricula of multi-disciplinary programmes provided by the respondent institutions. The average weights assessed by the contact persons are listed below.

CZ	**CTU**	Architecture and Civil Engineering	50 - 70%
		Safety and Risk Engineering	
		Buildings and Environment	
		Intelligent Buildings	
DE	**FH OOW**	European Civil Engineering Management	50%
		Civil Engineering Management	
		Economics in Civil Engineering	
		Facility Management	
DK	**DTU**	Architectural Engineering	66%
ES	**CU**	Master in environmental engineering	70%
FR	**EPPT**	Structures and architecture	70%
		Introduction to design	
		Works and environment	
IT	**UP**	Applied Geophysics	25%
NL	**DUT**	Transportation, Infrastructure and Logistics	25 - 50%
		Offshore Engineering	
		Geomatics	
PT	**UP**	Biomedical Engineering	50 - 75%
		Multimedia Engineering	
RO	**TUCEB**	Civil Engineering – Economics	50%
		Automation and Applied Informatics	25%
SK	**UŽ**	Transportation Planning	60%
		Technology and Construction Management	
		Forensic Engineering	

Concerning the existence of eventual peculiarities of the final project (thesis) content and/or the final examination procedures, compared with the common programmes provided by the institution, the following answers were received:

CZ	**CTU**	Architecture and Civil Engineering	N
		Safety and Risk Engineering	N
		Buildings and Environment	N
		Intelligent Buildings	N
DE	**FH OOW**	European Civil Engineering Management	Y*
		Civil Engineering Management	
		Economics in Civil Engineering	
		Facility Management	
DK	**DTU**	Architectural Engineering	N
ES	**CU**	Master in environmental engineering	N
FR	**EPPT**	Structures and architecture	Y
		Introduction to design	
		Works and environment	
IT	**UP**	Applied Geophysics	Y**
NL	**DUT**	Transportation, Infrastructure and Logistics	N
		Offshore Engineering	
		Geomatics	
PT	**UP**	Biomedical Engineering	N
		Multimedia Engineering	
RO	**TUCEB**	Civil Engineering - Economics	Y
		Automation and Applied Informatics	
SK	**UŽ**	Transportation Planning	N
		Technology and Construction Management	
		Forensic Engineering	

* no pure civil engineering topics in the thesis
** 40 credits for the final thesis instead of 15

The number of enrolled students and graduates per year (in the last 5 years) reported by the respondent institutions providing multi-disciplinary programmes are the following:

		enrolled	Graduates
CTU	Architecture and Civil Engineering	320 (U) 160(P)	160 (U)* 160 (P)*
	Safety and Risk Engineering	200 (P)	190 (P)
	Buildings and Environment		
	Intelligent Buildings		
FH OOW	European Civil Engineering Management	150	70
	Civil Engineering Management		
	Economics in Civil Engineering		
	Facility Management		
DTU	Architectural Engineering	50	30
CU	Master in environmental engineering	15	12
EPPT	Structures and architecture	15	
	Introduction to design		
	Works and environment		
UP	Applied Geophysics	50	15
DUT	Transportation, Infrastructure and Logistics	5 - 30	5 – 30
	Offshore Engineering		
	Geomatics		
UP	Biomedical Engineering	50**	45
	Multimedia Engineering		
TUCEB	Civil Engineering – Economics	100	60
	Automation and Applied Informatics	50	35
UŽ	Transportation Planning	55	
	Technology and Construction Management	55	
	Forensic Engineering	5***	

* U – undergraduate; P - postgraduate
** 30 on the internet page of the university
*** only PhD programme

4.1 Brief comments on the received answers

1. The institutions where inter/multidisciplinary degree programmes are present are providing between 1 and 4 such degree programmes. A total number of 24 different programmes are listed. At least 3 of them are doubtful to be placed in the category defined in the terms of references of EUCEET III (they are typed with *italic* in the table concerning the titles).

2. Inter/multidisciplinary programmes are recently provided programmes, started after 1992, most of them after 2000.

3. All programmes are permanent ones (although they are sometimes conditioned by a minimum number of students).

4. In all cases the inter/multidisciplinary degree programmes are organized at faculty/department level. For some programmes the contribution of several higher education institutions is mentioned.

5. The main reason reported for delivering an inter/multidisciplinary programme is in all answers **the demand of industry** (the job market). Additionally, 2 answers mentioned also the demand of high school/first degree graduates and 1 answer mentioned the cooperation proposal expressed by another institution.

6. In most cases there are no special (peculiar) admission procedures, compared with the common programmes provided by the same institutions, except 3 answers, two of them being explained by aptitude exams and one by supplementary admission subjects.

7. Concerning the schedule, 7 out of 24 multidisciplinary programmes are different compared with the common ones.

8. The weight of civil engineering subjects among the curricula of the multidisciplinary programmes ranges in most answers between 50% and 75% (with 2 exceptions where the weight of civil engineering subjects is lower). However, at least other 2 answers are doubtful, because of their declared specializations.

9. The final assessment (diploma project or dissertation paper) differs compared with the common programmes in only 2 anwers.

10. The total number of students is generally low, especially for postgraduate programmes (between 5 students for PhD degrees and 30 students for

Master degrees), except those provided by CTU – Prague with a mean value of 50 students per programme. For the undergraduate programmes, the number of students rises between averages of 15 to 80 students per programme.

4.2 Respondents' opinions

The last part of the questionnaire is dedicated to respondents' opinion regarding the benefits of promoting the multidisciplinary programmes. Below are listed the received answers.

1. Concerning the improvements of graduates' competences

CZ	**CTU**	Except for the programme "Architecture and Civil Engineering" there is concern about rather narrower specialization, which however, may be an advantage if graduate gains appropriate job
DE	**FH OOW**	The market needs such interdisciplinary educated students
DK	**DTU**	A gap between architects trade and the trade of the analytical civil engineers is filled. The candidates have been well received in both consulting engr. firms and in architect companies
ES	**CU**	They obtain a specialization in Environmental Engineering, in classic areas as Water, Waste and Soil, or Air, as well as in Environmental Quality Management, Treatment Technologies or Operation and Control. The focus of learning could be research (way to PhD) or practice (way to Professional Engineer)
FR	**EPPT**	Best comprehension of the architects way of thinking, attraction and curiosity for specific technical topics
IT	**UP**	Very qualified graduates capable of facing complex problems co operating with other professionals
NL	**DUT**	Students have been educated in fields which were not yet covered, Also multidisciplinary approach seems to make students more generalists, which are able to work in many different disciplines.
PT	**UP**	Increased competences in the area
RO	**TUCEB**	Civil engineers with competences in the economic managerial domain

2. Concerning the improved perspectives of the multi-disciplinary programme graduates in the labour/ job market

CZ	**CTU**	YES. Civil engineering architects are very successful. What concerns other graduates depends on their jobs and abilities
DE	**FH OOW**	NO special
DK	**DTU**	YES. They are well received by industry. They fill a niche and thus do not "enhance" their position compared to other candidates
ES	**CU**	YES. The perspectives are good. Normally the students find a job after graduation, frequently in the company where they develop their professional practices.
FR	**EPPT**	YES. Several specific companies are directly concerned by those graduates, and huge companies are curious to recruit graduates with various skills
IT	**UP**	YES. Anyway they are not Civil Engineers! Not possible to compare
NL	**DUT**	YES. Job opportunities are very good for all of our students including graduates of the multi-disciplinary programmes, there is no difference
PT	**UP**	YES. Good employability rate
RO	**TUCEB**	YES. The graduates of this multi-disciplinary programme are requested by the labour market

3. Concerning the enhancement of candidates' interest for multi-disciplinary programmes in the last years

CZ	**CTU**	YES, to study Architecture and Civil Engineering is very popular and the number of students is limited by high entry requirements
DE	**FH OOW**	NO special
DK	**DTU**	YES, increasing number for BEng, restricted to 50 students/year
ES	**CU**	YES. With the application of EEES in Spain our former programmes in Environmental Engineering have obtained the official certification. Thus the candidates' interest has enhanced
FR	**EPPT**	YES, Augmentation of candidates with 40% in 2 years
IT	**UP**	YES. The number of applicants has strongly increased year by year. Students come to Pisa and Milan from many part of Italy and also from abroad
NL	**DUT**	Some programmes still grow, one programme (Geomatics) doesn't
PT	**UP**	YES, popular subjects

RO	**TUCEB**	YES, the interest of the candidates is shown by the considerable number of persons involved in the admission process and also the interest is the answer for the requested qualification on the labour market

5. EXAMPLES OF MULTI-DISCIPLINARY PROGRAMMES (INTERNET PAGES OR ANNEXES TO THE RECEIVED ANSWERS)

5.1. Czech Technical University in Prague (CTU), Czech Republic Faculty of Civil Engineering (FCE) (www.fsv.cvut.cz)

Programme: Architecture and Civil Engineering

Bachelor and master studies provide theoretical and practical knowledge concerning complex problems of architectural and structural design of civil engineering structures and aesthetical – fine arts problems linked together with design and realization of structures.

5.1.1. Bachelor studies (Bc) (4 years/8 semesters)

The study starts with basic theoretical courses similarly as in other Civil Engineering programmes at FCE. Students receive knowledge of basic theoretical and professional engineering courses (such as civil engineering physics, structural mechanics, design of structures from various structural materials, geotechnics, buildings services, execution etc.). These courses slightly prevail over architectural courses as atelier creation, history of architecture, design of buildings, architectonics, restoration and renovation of historic buildings and urban planning.

The study is complemented with humane and economic courses and courses focused on IT knowledge, i.e. the use of computers and numerical methods in engineering practice including designing of structures and communication skills.

The Bachelor graduate is receiving knowledge in designing and carrying out of structures, required for asserting himself/herself in designing, contracting and developing companies. The education is also entitling him/her for professional activities within public sector, namely construction administration. The study due to its scope is a prerequisite for master studies in programmes Architecture and Civil Engineering (2 years), Buildings and Environment (1.5 years), Civil Engineering – focused on branch Civil Engineering Structures (1.5 year).

Study plan

1st semester:

Mathematics 1	6 credits	
Constructive geometry 1	5 credits	
Psychology and sociology	2 credits	
Structural materials	3 credits	
Architectural drawing 1	4 credits	
Buildings 1	3 credits	
Architectural composition 1	3 credits	
Geology	2 credits	
Informatics	2 credits	(optional)
Law (common)	2 credits	(optional)
Drawing of structures	2 credits	(optional)
(Physical training 1)	0 credits	
Total required:	30 credits	

2nd semester:

Mathematics 2	4 credits	
Constructive geometry 2	2 credits	
Civil eng. physics 1	2 credits	
Civil eng. structures 1	5 credits	
Architectural drawing 2	4 credits	
Architectural composition 2	3 credits	
Buildings 2	5 credits	
Structural mechanics 1	5 credits	
(Physical training 2)	0 credits	
Total required:	30 credits	

3rd semester:

Mathematics 3	4 credits	
Foreign language 1	2 credits	
Psychology and sociology	2 credits	
Structural materials	3 credits	
Architectural drawing 1	4 credits	
Civil eng. structures 2	5 credits	
Civil eng. physics 2	4 credits	
History of architecture 1	4 credits	
Buildings 3	5 credits	
Arch. composition studio	5 credits	

Elasticity and plasticity	4 credits	
Architectural drawing	0 credits	(optional)
(Physical training 3)	0 credits	
Total required:	30 credits	

4th semester:

Foreign language 2	2 credits	
Civil eng. structures 3	3 credits	
Civil eng. physics 3	2 credits	
History of architecture 2	3 credits	
Computer graphics	3 credits	
Buildings 4	2 credits	
Arch. composition studio	7 credits	
Structural mechanics 2	4 credits	
Soil mechanics and foundation	4 credits	
Drawing in open air	0 credits	(optional)
Training course	0 credits	
(Physical training 4)	0 credits	
Total required:	30 credits	

5th semester:

Civil eng. structures 4	4 credits	
Atelier 1	5 credits	
History of architecture 3	3 credits	
Buildings 5	2 credits	
Computer graphics 1	3 credits	
Reconstruction and conservation of historical buildings	3 credits	
Concrete and masonry structures 1	5 credits	
Steel and timber structures 1	5 credits	
Total required:	30 credits	

6th semester:

Civil eng. structures 5	4 credits	
Building services 1	5 credits	
Atelier 2	5 credits	
Computer graphics 2	3 credits	
Urbanism 1	3 credits	
Concrete and masonry structures 2	5 credits	
Steel and timber structures 2	3 credits	

Traffic engineering	2 credits
Total required:	30 credits

7th semester:

Civil eng. law	2 credits
Construction processes 1	4 credits
Building services 2	4 credits
Design management 1	3 credits
Atelier 3	7 credits
Urbanism 2	4 credits
Concrete and masonry structures 3	2 credits
Steel and timber structures 3	4 credits
Professional practice (3 weeks)	0 credits
Total required:	30 credits

8th semester:

Construction processes 2	3 credits
Design management 2	5 credits
Urbanism 3	4 credits
Engineering Surveying	5 credits
Bachelor thesis	13 credits
Total required:	30 credits

5.1.2. Master studies (Ms) (2 years/4 semesters)

The Master studies unlike the Bachelor ones cover mostly courses from the field of architecture (special courses on buildings, history of architecture and arts, outdoor and landscape creation, drawing and painting, model designing) and architectural creation. The main emphasis is put on atelier courses including interior design and city planning. Architectural courses are supplemented by theoretical, engineering, economical and humanistic courses in a balanced composition to provide complex education serving for quality asserting in practice.

The Master graduate (Eng. arch.) asserts himself/herself as a creative designer – architect in the field of concept design of all civil engineering structures and as a principal co-ordinator and design engineer including filed of realisation of structures. The education is also entitling him/her for professional activities within public sector, namely construction administration, conservation of historical buildings, civil engineering research and education. The Master studies graduation is a prerequisite for continuation in doctoral studies.

There are 2 branches of master studies:

a) Architecture and civil engineering.
b) Architecture and urbanism.

Study plan

1st semester:

Urbanism 4	2 credits
Tech. infrastructure of settlements	2 credits
Urbanistic atelier	5 credits
Atelier 4	8 credits
Interior 1	5 credits
Courses of branch a) or b)	
Total required:	30 credits

2nd semester:

Outdoor and landscape creation	4 credits
Atelier 5	8 credits
History of architecture 4	3 credits
Computer graphics	3 credits
Courses of branch a) or b)	
Total required:	30 credits

3rd semester:

Aesthetics and sociology	3 credits
Buildings and energy	2 credits
Management of company	4 credits
Atelier 6	8 credits
History of architecture 4	3 credits
Environment	2 credits
History of arts	3 credits
Courses of branch a) or b)	
Total required:	30 credits

4th semester:

Diploma thesis	
Total required:	30 credits

Courses branches

a) Architecture and civil engineering:

Civil eng. structures 6	4 credits
Buildings 6	2 credits
Architecture of eng. structures	2 credits
Civil eng. structures 7	3 credits
Special steel and timber structures	3 credits
Interior 2	6 credits
Theory of contemporary architecture	3 credits
Eng.–historical analysis of buildings	2 credits
Special concrete structures	3 credits

b) Architecture and urbanism:

Urban structure of settlements	4 credits
City interior and urban detail	4 credits
City planning	3 credits
Urban and landscape composition	2 credits
Development and regeneration of towns	2 credits
Urban economy and management	2 credits
Interior 2	6 credits
Present and urban perspectives	2 credits
Information systems and GIS	2 credits
Tools of landscape planning	4 credits

5.2. Technical University of Denmark, DTU, Lyngby, Denmark [www.byg.dtu.dk]

Programme: Architectural Engineering

Architectural engineers are involved in all facets of design of buildings and building systems, including planning, structural form finding, structural design, design of services, building envelopes, indoor climate, fire safety and acoustics.

The study for M.Sc. in architectural engineering at DTU gives a profound technological background from engineering disciplines combined with competences for creating syntheses and corporate with other professionals in building design. Where a traditional M.Sc. in Civil Engineering has high competences in analysis and documentation of a final design, the M.Sc. in Architectural Engineering from DTU has special competences for participating

in early phases of a design process, where important decisions are made about the overall shape, structure, and functionality of the building based on a limited information level. This calls for a good basic understanding of the behaviour of buildings and structures and for an ability to define and treat simple engineering models leading to conclusions concerning constructability and performance based on a minimum of parameters.

The MSc education in Architectural Engineering offers study-lines in structural design and in energy design. Additional individual specialization is possible through elective courses comprising a variety of subjects such as structural glazing, seismic design, light structures, facades, acoustics, lighting, construction management and town plans.

It is also possible to earn an MSc in Architectural Engineering without a study-line.

Study-lines: a. Structural Design
b. Energy Design

Career Opportunities

Architectural Engineering graduates are employed by architects, consulting engineers, contractors, researchers, building component manufactures, authorities, municipalities, and as independent consultants. The field of activity ranges from preliminary identification of design parameters and indication of design solutions over participation and organisation of a design process, communication, documentation, presentation, realisation, and operation of projects for buildings or building products.

Academic Requirements

BSc degree in Architectural Engineering with Basics of:

- Architecture and design
- History of architecture and the background of architectural engineering
- Physics and mathematics incl. differential equations
- Building materials
- Structural design in steel, concrete, and wood
- Building physics including heat and moisture transport
- CAD
- The Finite Element Method or Computational Fluid Dynamics

Applicants who have completed DTU's BSc in Civil Engineering are encouraged to supplement their education with elements of architecture, design and history of architecture, and will need to incorporate an introduction course

on this in the M. Sc. education to meet the preconditions for the courses of the education.

Applicants who have completed DTU's 3.5-year Bachelor in Building Design are qualified for this program with the following supplementary requirements. It is required that at least 10 points from among the following courses form part of their program, before the master education is started.

Advanced Engineering Mathematics 2	5	points
Probability theory	5	points
Statistical Quality Control	5	points
Introduction to Numerical Algorithms	5	points
The Finite Element Method	5	points

Study Plan for MSc in Architectural Engineering

The master education in Architectural Engineering gives the general specialisation competences of building design and architecture through project oriented work in which emphasis is on both synthesis and in depth study of the technological engineering problems. The technological courses which are relevant for structural design and energy design can with great advantage be grouped and chosen as proposed in the specialisations. The possibility of individual specialisation exists through the elective courses.

Programme provisions

To obtain the MSc degree in Civil Engineering, the student must fulfil the following requirements:

- Have passed General Competence Courses adding up to at least 30 points
- Have passed Technological Specialization Courses adding up to at least 30 points
- Have performed a Master Thesis of at least 30 points within the field of the general program
- Have passed a sufficient number of Elective Courses to bring the total number of points of the entire study up to 120

General Competence Courses

Compulsory (30 points):

Fire Safety in buildings	5	points
Advanced Building Design	10	points

Building component design	10	points
Integrated Structural Project	10	points
Integrated Functional Project	10	points
Building acoustics	5	points

The courses listed below also count as General Competence courses to students accepted at DTU prior to September 2009:

Structural Semester Project B	10	points
Functional Semester Project B	10	points
Functional Semester Project A	10	points

Technological Specialization Courses

Structural Design

Structural Fire Safety Design	5	points
Super-light structures	5	points
Building Renovation and Rebuilding	5	points
Computational structural modelling: plates and shells	5	points
Structural Analysis of buildings	5	points
Advanced Concrete Structures	5	points
Advanced Steel Structures	5	points
Advanced Wood Structures	5	points
Structural Design	5	points

Energy Design

Fire dynamics	5	points
Building Renovation and Rebuilding	5	points
Building energy and technical services - Integrated design	5	points
Sustainable Buildings	10	points
Energy End-Use Savings and the Environment	5	points
Daylight in buildings	5	points
Heat and mass transfer in buildings	5	points
Sustainable heating and cooling of buildings	5	points
Indoor Climate	10	points

The courses listed below also count as Technological Specialization courses to students accepted at DTU prior to September 2009:

Technical Building Services 2	5	points
Thermal Building Physics	5	points

Elective Courses

In principle, all advanced level courses at DTU are elective. The most relevant for the study line are given here:

Structural Design

Fire Safety in buildings	5	points
Fire dynamics	5	points
CAD for Civil Engineers 2	5	points
Computational Fluid Dynamics on Buildings	5	points
Indoor Climate	10	points
Glass and Glass Structures	5	points
Advanced FEM: Materials Modeling	10	points
Seismic and Wind Engineering	10	points
Bridge Structures	7.5	points
Soil and Rocks in the Build Environment	5	points
Advanced Soil Mechanics	5	points
Advanced Geotechnical Engineering	5	points
Concrete Technology	5	points
Wood Science and Technology	5	points
Architectural Acoustics	10	points
Building acoustics	5	points
Environmental Acoustics	5	points
Advanced Acoustics	10	points
Dynamics of Structures: Theory and Analysis	7.5	points
Plate and Shell Structures	5	points
Industrial Production Concepts in Construction	10	points
Facilities Management	5	points
Study tour to a large construction project	10	points

Energy Designs

Fire Safety in buildings	5	points
Structural Fire Safety Design	5	points
CAD for Civil Engineers 2	5	points
Solar Heating Systems	10	points
Numerical Methods for Building Energy Technology	7.5	points
Energy End-Use Savings and the Environment	5	points
Experimental Methods in Building Energy and Indoor Climate	5	points
Computational Fluid Dynamics on Buildings	5	points
Ventilation and Climatic Systems	10	points

Urban drainage systems	5	points
Architectural Acoustics	10	points
Building acoustics	5	points
Environmental Acoustics	5	points
Advanced Acoustics	10	points
Facilities Management	5	points

Master Thesis

The program is completed through a Master Thesis relevant for the program. It is also possible to make a project at another department and in this case the subject of the project must be approved by the program coordinator or the secretariat of study. The work load of the project should correspond to 30, 35, 40, 45 or 50 points. A Master Thesis of 30 points must be undertaken as a full-time course of study for five months plus any agreed holiday time. If the Master Thesis is more than 30 points, the period will be extended with 3 weeks for every 5 additional points. Exceptions can be made in cases of documented physical or psychical learning disabilities. The Master Thesis and the Elective Courses must comprise 60 points altogether.

5.3. Technical University of Civil Engineering, Bucharest, Romania (www.utcb.ro)

Programme: Civil Engineering–Economics

The engineers specialized in Civil Engineering–Economics are involved in all phases of the investment process of the construction field starting with the prefeasibility study, feasibility study, design, contracting, execution works and maintenance.

The graduates' background is both in the engineering and economics domains with competences in cost estimating, project planning, monitoring and controlling as well as financial aspects of the construction projects.

Career Opportunities

The labour market is interested by this kind of graduates and the opportunities regarding the career are related to the banking system, especially in the investment department, consultants, evaluation and technical experts and so on.

The graduates of the multi-disciplinary programme Civil Engineering–Economics will have the abilities for performing technical projects as well as technical-economical evaluation related to the construction works, feasibility studies and cost evaluation.

Academic Requirements

The candidates should have the baccalaureate.

Applicants will have to take an admission exam (written) where there will be evaluated the knowledge level of the candidates in the specified domain.

Programme provisions

To obtain the BSc degree in Civil Engineering–Economics the student must fulfil the following requirements:

- Have passed the 8 semester with 30 credits each
- Have performed a Graduation Project that should have a part of structural design, a project management part and an economical part

Study Plan

1st Semester:

Analisys I	5 credits
Linear algebra	5 credits
Descriptive geomery	5 credits
Informatics	4 credits
Chemistry	2 credits
Surveying	5 credits
Humanities	2 credits

2nd Semester:

Analisys II	4 credits
Informatics II	5 credits
Mechanics I	5 credits
Economics	4 credits
Construction Materials	4 credits
Technical Drawings	2 credits
Architecture	1 credit
Humanities	1 credit

3rd Semester:

Statistics	4 credits
Mechanics II	5 credits
Strength of materials	5 credits
Phisiscs	4 credits
Infographics	3 credits
Business Communocation	2 credits
Enterprise Economics	4 credits
Environment Engineering	1 credit

4th Semester:

Strength of materials	6 credits
Structural analisys	6 credits
Civil and commercial law	2 credits
Economic Politics	2 credits
Operational research	4 credits
Transport engineering	2 credits
Accounting	5 credits
Construction machines	2 credits

5th Semester:

Structural analisys II	5 credits
Edilitary constructions	3 credits
Marketing	3 credits
Human Resources Management	3 credits
Buildings I	6 credits
Prestressed and reinforced concrete	5 credits
Soil mechanics	5 credits

6th Semester:

Dynamics and eaethquake engineering	4 credits
Prestressed and reinforced concrete	4 credits
Foundations	4 credits
Building II	4 credits
Steel structures	4 credits
Technology	2 credits
Constructions Law	2 credits
Construction Quality Managment	2 credits

7th Semester:

Reinforced concrete	7 credits
Construction Economics	5 credits
Construction Management	3 credits
Steel Structures II	7 credits
Technology	5 credits
Bidding, offers, contracts	3 credits
Finite element method	3 credits
Special Foundations	3 credits

8th Semester:

Construction Management	6 credits
Informational Systems	5 credits
Equipment for buildings	4 credits
Finance and Credits	4 credits
Economic efficiency	5 credits
Costruction evaluation	3 credits
Construction testing	2 credits
Business management	2 credits
Masonry and wood structure design	3 credits
Final graduation project	30 credits

Programme: Master in Construction Project Management

The graduates of the Master programme Construction Project Management are able to design and realize the construction activities by choosing the most appropriate solutions and economic options under a good management conditions.

The aim of the programme is to establish and realized the construction activities based on a project, to inform, communicate and run projects.

The one who graduate this multi-disciplinary programme Master of Construction Project Management will have abilities in financing, controlling, monitoring and evaluating investment projects, as well as they have competences in marketing activity of the projects.

Career Opportunities

The Construction Project Management graduates are able to work in the investment process as project manager or they can be employed by the consultancy companies.

Academic Requirements

The candidates will need to have a BSc degree in engineering.

The admission process is made by 2 parts: one written part where is measured the knowledge of candidates in the specified domain and one practice part that measure the computer skills of the candidates needed for the use of the computer programs in the project management during the master classes.

Program provisions

To obtain the MSc degree in Construction Project Management the student must fulfil the following requirements:

- Have passed the 3 semester with 30 credits each
- Have performed a Master Thesis within the Management Department from the Technical University of Civil Engineering based on one of the subject studied during the master courses.

Study Plan

1st Semester:

Operational research in project management	5 credits
Marketing and projects promotion	5 credits
Company management	5 credits
Quality management system in construction	5 credits
i). Business communication and negotiation ii).Financial management of projects	5 credits
i). Managerial strategies in future organisations ii).Risk project management	5 credits

2nd Semester:

Environment protection management	5 credits
Technical-economical documentation – computer methods	5 credits
Construction cost engineering	4 credits
Team project management	5 credits
i). Statistics ii).Monitoring and control of the investments in construction	4 credits
i). Business law ii). Health and security management	4 credits

3rd Semester:

Construction project management	6 credits
Advanced techniques for planning and controlling the construction works	6 credits
Financial analisys	6 credits
i). Company diagnosis ii).Optimising the project processes	5 credits
i). Informational systems for project management ii).Facility management	4 credits
Final Master Thesis	30 credits

5.4. University of Applied Sciences FH OOW, Oldenburg, Germany (www.fh-oow.de)

Programme: European Civil Engineering Management (ECEM)

In view of the increasing EU wide competition for projects in foreign countries and teamwork with civil engineering partners from all over Europe there is a demand for experts performing technical perfection and realising projects within fixed time and cost schedules.

So there is a need for civil engineers who are not only good engineers but at the same time are managers who can develop projects, take business management aspects into account and who can be employed internationally due to their language skills.

The ECEM course of studies in Oldenburg is the only integrated European course of studies meeting these requirements: the classic training of civil engineers is linked to a managerial training complemented by technical English and a second foreign language. Additionally the one year study abroad greatly fosters the required social and cultural competence.

Special features of ECEM

ECEM is an international course of studies; at present the FH in Oldenburg offers this course in conjunction with partner universities in Budapest (H), Cachan near Paris (F), Galway (IRL), Groningen (NL), Halmstad (S), Prague (CZ), Szczecin (PL), Valencia (E), Wolverhampton (GB), Moscow (RUS) and Dundee (SCO).

The course of studies comprises two semesters in theory and one industrial placement semester at one of the above partner universities. These studies abroad are certified in the bachelor certificate.

The strengths of ECEM graduates are organisational skills, pronounced cost awareness, sound knowledge in building law and management economics, language and cultural competence, personal mobility and teamwork skills.

Graduates of the ECEM course of studies can be employed

- in the building industry
- in engineering and architectural offices
- in departments of building and planning authorities
- in public or commercial building offices
- in project development offices
- in international planning and construction companies
- in banks and insurance companies.

Career outlines of ECEM-Graduates

They can work in the following fields:

- site supervision
- project management
- contracting
- execution planning
- action planning
- bidding calculation, quantity surveying
- calculation/estimating
- quality management
- procurement of new projects
- project development
- turnkey construction.

Preconditions for studying ECEM at FH OOW in Oldenburg

Exchange students should have a sound knowledge of the German language as lectures are in German only. The individual regulations for studying ECEM at a partner university abroad depend on the regulations of the individual home university and on the agreements between the individual partner universities.

6. CONCLUDING REMARKS

Civil Engineering is itself a multidisciplinary domain of science and technology. It is sufficient to analyze the final reports of EUCEET, concerning the specializations offered by various degree programmes in higher education institution across Europe, including their curricula content, to notice that very few fields of science and technology are so comprehensive.

Most higher education institutions in Civil Engineering provide degree programmes related to environmental and/or environment protection fields, as well as economical and management aspects, without being inter or multidisciplinary programmes, within the meaning expressed by Theme D. This was obviously the interpretation of the large majority of EUCEET partners and the reason for the low rate of participation. Unfortunately, even if some suggestion were made during the WG meeting, they were not followed by the expected answers.

Despite these facts, or maybe because of them, the survey occasioned by the questionnaire yields a reduced number of confirmatory answers, referring the existence of inter/multidisciplinary programmes. Moreover, some of these answers are confusing the interpretation, the presence of various specializations in the same degree programme being considered as multidisciplinary. Anyhow, the survey reveals the fact that organizing inter/multidisciplinary programmes is not a current practice among Civil Engineering universities in Europe.

Some reasons can be found in the difficulty to increase the curricular content in the framework of similar schedules (teaching hours, student workload, etc) and a comparable ECTS number. These constraints lead to a contradiction between the narrow, in-depth specializations and a larger perspective over civil engineering and the interconnected fields. It is interesting, however, to notice a new approach (promoted by some respondents), emphasizing the role of generalization in detriment to narrow specialization, with employment advantages for graduates.

The few answers are examples of joining civil engineering with architecture, environmental science, IT, geosciences, modern survey and land measurement methods, Geographic Information Systems, forensic engineering. A possible joining not explicitly revealed by the answers, but mentioned in referenced papers, is civil engineering with law studies, which may be of interest for those components of the labour market related to local community development or administration.

Most of the examples are located at postgraduate level. It is more likely that the existing programmes were developed according to the local demands of the job market and/or due to the justified intention of institutions to enhance their attractiveness to candidates. A relative low number of students are involved in inter/multidisciplinary programmes, compared with the total number of students registered in EUCEET partner institutions.

The respondents mentioned as main advantages of their inter/multidisciplinary programmes the enhancement of competences of graduates, together with the augmentation of their chances in respect of the labour market. However, due to the low number of enrolled students, one of the shortcomings of this type of programmes is the fact that they are more resource consuming then ordinary degrees, from logistic and staff involvement points of view.

All assumed inter/multidisciplinary programmes are permanent ones, since the moment they were launched (except some conditionings referring to the minimum number of students). An option to stable inter/multidisciplinary programmes, at least for postgraduate studies, would be the organization of degree programmes based on specific (thematic) projects, involving the higher education institution (or several ones), as a demand of research, industry or administration (community) needs. Such programmes could last only the necessary number of education cycles, being replaced according to necessities.

Finally, the chairman of the working group dealing with Theme D of EUCEET III expresses his gratitude to those representatives of partner institutions who answered the questionnaire and contributed with suggestions during the working group meetings. Special thanks to professors Daniela Preda (TUCE Bucharest), Josef Machacek and Vaclav Kuraz (CTU Prague) for the detailed annexes of their responses.

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ANNEX 1

QUESTIONAIRE THEME D

1. General information		
Name of the institution	- in original language	
	- in English	
Name of the Faculty/ Department		
City		
Country		
www address of the institution		
Respondent		
Position in the institution of the respondent		
e-mail address		

2. Multi-disciplinary (interdisciplinary) programmes	**[Y/N]**
Does your institution provide such programmes, involving Civil Engineering and other fields?	

3. For institutions providing multi-disciplinary (interdisciplinary) programmes

Are these programmes present at (please tick)	**[X]**
- undergraduate level	
- postgraduate level	
- both	

Name of the multi-disciplinary programme(s); for each programme please indicate the education level (undergraduate [U], postgraduate [P], both [B])		**[ ]**
- in original language		
- in English		
- in original language		
- in English		
- in original language		
- in English		

First academic year when each multi-disciplinary programme was organised	**[YEAR]**

The multi-disciplinary programme is (please tick)	[X]
- a permanent programme (since first organised)	
- a temporary programme	
The multi-disciplinary programme is the initiative of / is organised at (please tick)	[X]
- faculty/department level	
- university level	
- other; please specify:	

What was the reason for organising the multi-disciplinary programme(s)? (please tick)	[X]
- the request of high school/first degree graduates	
- the demand of industry (job market)?	
- other; please specify:	

Are there peculiarities of admission criteria for the multi-disciplinary programme (compared with the usual ones provided by the institution)?.	[Y/N]
If the case, please specify:	

Does the multi-disciplinary programme follow the same schedule (no. of semesters, teaching hours, etc) as other programmes provided by the institution?	[Y/N]
If the case, please specify:	

Weight of civil engineering subjects in the total work-load of the programme	[%]

Are there peculiarities of the final project (thesis) content and examination procedure?	[Y/N]
If the case, please specify:	

What is the awarded qualification? Please specify.

Average number of students involved in the multi-disciplinary programme per year (last 5 years)	[No]

Average number of multi-disciplinary programme graduates per year (last 5 years)	**[No]**

Brief description of the multi-disciplinary programme concerning its target, expected outcomes and curricula

4. Respondent's opinion

What are the improvements concerning the graduates competences? Please specify.

Which are the perspectives of graduates of the multi-disciplinary programme in the labour/job market? Are they enhanced compared with usual graduates?	**[Y/N]**
If the case, please detail:	

Do you notice an enhancement of candidates' interest for such programmes in the last years?	**[Y/N]**
If the case, please detail:	