

DEVELOPING A SYNERGY BETWEEN THE ACADEMIC AND PROFESSIONAL WORLDS

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1. INTRODUCTION

The proposal to extend the work of EUCEET into a third phase included a commitment to establish a Working Group to consider how to develop synergy between the academic and professional worlds. This would build on existing work undertaken by EUCEET, specifically Working Group C, which published a report dealing with synergies between universities, research institutes and public authorities working in the Construction Sector, and Working Group F, dealing with the demands of the economic and professional sectors and their impact on civil engineering education.

The work of the Group H began at the General Assembly, held in Santander during March 2007, where an agenda, terms of reference and outline of working methods were debated and the scope of possible work was drawn up.

2. SCOPE OF WORK

Group H was therefore established to consider ways in which academic and professional partners within the EUCEET Consortium can work together, and with Industrial colleagues where relevant, to promote a better understanding of their complementary roles in the formation of Engineers and to consider how further collaboration can be encouraged and enhanced. Following the launch at Santander, a number of changes to the terms of reference and scope of work were suggested and by the end of 2008, a range of possibilities had been identified, which are listed below.

- To collect available information on what Industry looks for when appointing Engineers and to disseminate this information amongst EUCEET members so that it may influence the process of formation of engineers.
- To compile a dossier of this information to be made available to all EUCEET members to assist them when updating their curricula.
- To investigate and compare the different forms of industry/university partnerships in diploma studies, in-course industrial training and professional experience which provide the practical formation of a Civil Engineer in each Member State. This may include the collection of information on ways in which academe and the professional domain currently interact and is likely to include specialist lectures, industrial advisory committees, assistance with design teaching, industrial placements, etc.
- On the basis of the above, to identify the best examples of innovative practice in these collaborations and to draw up guidelines, or best practice, on how such collaborations may be enhanced and extended.
- Recognising the potential importance of the free mobility of Engineers wishing to work in different countries within the EU, to develop a Common Platform for Civil Engineering. This may be defined as a set of criteria for professional qualifications which are suitable for compensating for the substantial differences which have been identified between the training requirements existing in the various Member States
- In order to assist in overcoming the problem of recognition, to offer a 'Quality Badge', perhaps along the lines of the Eurobachelor offered by the Chemistry Thematic network.
- To hold Workshops to which Industrial representatives would be invited to discuss the question of what Industry looks for in its young engineers. Such Workshop might also be a forum for posters illustrating innovative interactions with Industry and examples of good practice.

3. WORKING METHODS

Early on, we took the view that a considerable amount of information concerning Industrial links, needs of Industry, future educational directions and related matters already exists in the public domain,

so our approach should be to review this and make its existence more widely known, rather than to carry out surveys de novo. However it was recognised that some survey activity would be necessary, for example, to update the nature of existing links and to compile details of new and innovative curriculum links with companies. However the general approach would be to complement and supplement existing work, not to repeat it.

It was therefore agreed that the main method of working would be via Working Group discussions supplemented by correspondence, e-mails and website postings, but it would be necessary from time to time to convene small ad hoc Groups for specialist discussions and for drafting documents. Membership of such Groups would be determined according to the task in hand.

4. REVISED TERMS OF REFERENCE

In the 18 months between the Group's launch in Santander in March 2007 and the General Assembly in Warsaw in October 2008, considerable revision to the aims and objectives of the Group took place, via discussions, e-mail exchanges and meetings. A certain amount of over-ambitiousness was recognised, particularly where there was considered to be a risk of EUCEET straying outside its sphere of real expertise. Another issue was one of resources; it became clear that members simply did not have the capability and the time to cover all the topics identified above, nor did it seem likely that Industrial colleagues would be willing to spend their time in completing more questionnaires and providing more details, at a time when their own resources are being stretched heavily. The third issue was one of repetition. Most countries had already undertaken a great deal of work to collect information germane to the issues being discussed here and it seemed much more sensible to make proper use of this existing material rather than embark on another information collection exercise. This certainly applied to the question of the Common Platform, but other issues, including the Quality Badge and Industrial Workshops, were considered to be too far outside the scope of the Group.

4.1 The Common Platform

The discussion on the Common Platform was led by members who also hold positions within Professional Bodies, including Carsten Ahrens (DE), Fernando Branco (P), Nicos Neocleous (CY), Tugrul Tankut (T), and were supplemented by further discussions with The Institution of Civil Engineers and Engineering Council (UK) and CNISF (FR). The Common Platform is intended as a procedure for facilitating the recognition of professional qualifications between EU Countries, to allow Engineers freedom of movement to work across EU borders. Essentially it can be defined as a set of criteria for professional qualifications which are suitable for compensating for the substantial differences which have been identified between the training requirements existing in the various Member States. It would be expected to include the validation of acquired experience, both academic and professional, coupled to a programme of continuing professional development.

The main point for Group H was that the Common Platform was seen primarily as a matter for the Profession, not the Academic community, and that EUCEET, an organisation comprised mainly of academic institutions, would find it difficult to take the lead in such a project. Furthermore, the different stakeholders have quite different roles in this matter. Universities start by equipping students with the fundamentals of the discipline and generic skills such as IT, communication and presentation, etc. Industry must find, employ and retain competent, useful and creative staff, training them in-house to fulfil company requirements. Regulators (Governments or Professional Bodies) need to be able to assess and compare qualifications and work experience. The main reasons for our difficulties are set out below.

- Discussions had been under way on this topic for many years and the most obvious routes to a Common Platform (eg the FEANI EurEng) had already been shown not to be suitable.
- The task was clearly a very difficult one, yet the number of professionals choosing to work in other countries and not being able to do so had been remarkably small, mainly freelance professionals. Would it be worth the effort to set up an inevitably complex bureaucracy which would probably only benefit a small number of people?
- At various times, policy had switched from the idea of a Common Platform for the whole of Engineering to one of a CP for disciplines within Engineering.
- Even amongst like-minded people working in the Profession, it was difficult, if not impossible, to come up with a definition of Civil Engineering acceptable to all Member States.

- There was a conflict between the drive to regulate and control Professions and the predominant ‘free trade’ ethic, which would not easily be resolved and which EUCET was not well placed to influence.

Despite this, the need to protect the title of Civil Engineering was recognised, as was the principle of allowing appropriately qualified people to practice their profession in any country. This being so, members saw an important role for Group H in assisting ECCE, the European Council of Civil Engineers, in its deliberations on the Common Platform, but not in taking a lead in this matter.

4.2 The Quality Badge

Although the promotion and maintenance of quality is a key objective of any University at a local level, it is normal for an overview to be taken by a national agency, albeit one which uses the expertise of academics and former academics, often as specialists or consultants. While recognising the potential importance of this matter, we consider it inappropriate for EUCET to play a major role. This is something best left to national agencies or perhaps to a pan-European grouping of national quality agencies. The role of EUCET, the EUCET Association or individual members should be to act as technical and educational specialists.

4.3 Industrial Workshops

The possibility of EUCET organising Industrial Workshops to develop synergies was actively considered. Most members have good networks of industrial contacts and a good understanding of sector needs within their region or country and many already organise meetings and discussions. In addition, there is a considerable literature of Government and Professional reports dealing with the needs of Industry and how the academic sector might be able to meet these. EUCET certainly has a role to play in gathering and disseminating information about Industrial needs, by collecting this information, summarising and disseminating it as part of a national ‘State of the Art Report’ for individual countries. However, detailed work is probably best done at local level, based on existing networks and contacts.

5. FINAL TERMS OF REFERENCE

With all this in mind, the terms of reference of the Group were finally limited to three main areas:

- A brief survey of the nature of current links between Companies and Universities
- Collection of information on innovations and good practice: innovative ways of working with Industry
- National ‘State of the Art’ Reports

5.1 A Survey of Current Links

This was intended as very brief survey which would allow us to update our information on the type of links which exist between Companies and Universities, including information on how important these links are considered to be. All EUCET members were invited to complete a questionnaire and results are given in section 6.

5.2 Innovative Ways of Working with Industry

The idea here was to gather together examples of innovative links with Industry and the Profession which we can publicise amongst our colleagues as examples of good practice. All EUCET members were provided with details of some ‘good and innovative’ example of how Universities are linking up with Industry to enhance both the curriculum and the student experience, and were asked to provide similar or better examples from their own Institution. This information would then be compiled and used as a handbook of good ideas. Details are given in section 7.

5.3 National ‘State of the Art’ Reports

Here, nominated authors were invited to prepare a summary, based on existing documents such as Government and Professional Body reports, articles in the technical and professional press, etc, summarising current views and opinions of industrial/academic issues, focussing on the topics listed below:

- Manpower supply for Industry
- Quality & competency of current graduate output
- Difficulty or otherwise of finding and returning suitably qualified personnel
- Future training needs
- Perceived/ required changes in engineering education
- Impact of the current economic crisis

A template document, representing the situation in the UK, was circulated as a guide to what was needed, and the nominated authors submitted material relevant to their countries. A summary of the key issues raised in these reports is set out in section 8 and the reports themselves are given in Appendix 2 of this report..

6. THE NATURE OF CURRENT INTERACTIONS WITH INDUSTRY

The Group carried out a short survey in order to provide an update on the type of links which exist between Companies and Universities, including information on how important these links are. Most university Departments already have significant links with Industry and the Professions and many of these are well established and fairly standard. Earlier work (eg EUCEET Working Groups C and F) has covered this topic, and this survey is intended simply as an update. Contributors were asked to indicate the type of interactions they have and how important they are to the University, by completing the table below, on a scale of 1-5, 1 being very important, 5 being of no importance. Five typical examples are given, many contributors added others.

ITEM	1	2	3	4	5	N/A
Use of Industrialists to give special lectures						
Site visits for students						
Placements in Industry						
Careers advice provided by Companies						
Use of Industrialists in specialist practical areas, eg design classes						
Use of Industrialists in specialist teaching areas eg construction management						

Twenty-two submissions were received and the results are given below.

6.1 Use of Industrialists to give special lectures

All but one of the replies indicated the use of Industrialists to give special lectures and 67% said that this was an important or very important example of collaboration. 18% were neutral on this and 9% thought this was not very important.

6.2 Site visits for students

All respondents organise site visits. 72% consider that the use of site visits for students is important or very important, while 22% think that this is not very important or not important at all.

6.3 Placements in Industry

Again, all respondents have industrial placements of one sort or another. 64% think that this provision is important/very important for their students, while only 14% consider that this is not at all important.

6.4 Careers advice provided by Companies

All but one respondent makes use of careers advice for students provided by Companies and of these, 50% say that this is either important or very important. 18% are neutral and the rest (23%) say that is not important.

6.5 Use of Industrialists in specialist areas, eg design classes

9% of respondents do not use Industrialists as specialists in their design classes, but of the majority which does, 54% considers this to be important/very important, and only 13% say that it is not important.

6.6 Use of Industrialists in specialist areas eg construction management

18% of respondents do not use industrial experts in the teaching of construction management, but it is not clear if this is because they do not teach this subject, or that they do, but teach it themselves. Of those using industrial specialists, 50% consider this link to be important/very important and 13% say that it is not important.

6.7 Other types of links

Respondents listed 20 other ways in which their teaching is supplemented by links with Industry, but because these were not on the original list, it is not possible to say how widely used they are. Some of them are very similar, so they have been summarised and listed here, as suggestions and recommendations of how Universities might be able to extend their links to Companies, if they are not doing these things already.

- Use of Companies to give whole specialist courses
- Presentation of the activities of Companies and Professional bodies
- Involvement of Companies in final year projects, thesis and dissertation work, both as technical collaborators and as examiners. This can lead to a good appreciation of applied research and problem solving for Companies
- Use of Industrialists to serve on University Committees, Boards and Special Strategy Groups
- Provision of scholarships to students
- Sponsorship of Student Associations and Student Unions
- Construction fairs and exhibitions organised by students
- Professional Days and conferences organised by Companies
- Induction programmes for new students, involving Professional Bodies, Companies and Unions. This introduces the Construction Sector in a very practical way
- Summer vacation work, internships and assistance with first employment after graduation
- Collaboration with Companies over research and other innovative initiatives
- Establishment of professional standards, assistance with curriculum design and in setting out what student have to study
- Cooperation in lifelong learning programmes
- Industrial collaboration in design projects. This is an extension of the involvement in design classes indicated above

It is evident that many types of links exist already and that most Universities take the trouble to cultivate them and consider them to be important. The types of link which operate are not particularly unexpected, but some of the 'one off' suggestions listed above are worthy of wider consideration. For example, anything which enhances the exposure of student to real engineering life is likely to be beneficial all round, and anything which Companies can do to enhance the students' learning experience is likely to make a positive impression when it comes to employment of good graduates. This applies to the social side of University life (sponsoring student clubs and activities) as well as the educational side.

It also seems clear that external contributors can make a complementary contribution, bringing professional aspects which are much more the province of the Industrialist than the Academic. While the University rightly focuses on the fundamentals, the industrial contribution is better focussed on professional aspects including, for example, construction logistics, project management, civil engineering as a business and, perhaps most important of all, getting over the importance of professionalism in working life. The overall aim should be to strike a balance between scientific rigour and the inspiration which exposure to real case studies can do to motivate students.

7. INNOVATIVE WAYS OF WORKING WITH INDUSTRY

There has been much discussion in recent years about the need to revise and update curricula, and to make them more relevant to the needs of Industry. This section of the report describes a number of new initiatives designed to develop, extend and improve collaborations, bringing new approaches to study programmes. Some are refinements and developments of well-established forms of collaboration, while others are new and more innovative. Twenty five organisations contributed examples which fall into a number of categories, including:

- Opportunities to meet Companies and find out what they are doing
- Finding out about career opportunities
- Being inspired by exposure to real engineering problems
- Seeing ‘design’ in a wide context, involving technical, social, economic and environmental aspects
- Bringing industrialists into the teaching process, for professional expertise and for inspiration
- Promoting competitions, challenges and problem solving
- Supporting student life and social activities

The material submitted by Institutions is set out below as examples of good practice. Where possible, contact details are given so that those who are interested can seek further information. The organisations submitting material are listed below, alphabetically according to the way in which they are best known (shown in **bold**), followed by the material itself.

Budapest University of Technology and Economics, Hungary

Cardiff University, UK

Conseil Nationale des Ingenieurs et Scientifiques de France (**CNISF**), France

Technische Universitat, **Darmstadt**, Germany

TU **Delft**, Holland

TU **Denmark**

Ecole des Ponts Paris Tech (**ENPC**), France

Ecole Supérieure des Travaux Publics, du Bâtiment et l’Industrie (**ESTP**), Paris, France

Helsinki University of Technology, Finland

Imperial College London, UK

Institut National des Sciences Appliquées, (**INSA**), Lyon, France

Laboratoire Centrale des Ponts et Chaussées (**LCPC**), France

Institut Supérieur du Bâtiment et Travaux Publics, (**ISBA-TP**) **Marseille**, France

Middle East Technical University (**METU**), Ankara, Turkey

Fachhochschule **Oldenburg** (now the JADE Hochschule), Germany

University of **Pardubice**, Czech Republic

University of **Patras**, Greece

University of **Pisa**, Italy

Universidade do **Porto**, Portugal

Czech Technical University, **Prague**

TU **Riga**, Latvia

Escuela de Caminos de **Santander**, Spain

Technological Education Institution, **Serres**, Greece

TU **Tallinn**, Estonia

Timisoara, Romania

7.1 Budapest University of Technology and Economics (BUTE)

Contact: Antal Lovas alovas@mail.bme.hu

7.1.1 Civil Engineering Week

The Civil Engineering Week has been a major part of the life of the Faculty since October 2000. It takes place in the autumn semester organized by the students. The aim is to make connections between the students and professors with the companies who are from the civil engineering profession in Hungary. They can offer complex opportunities to our exhibitor Companies to show a wider picture

about their work, products and the technologies they are using. With a large set of presentation accessories, the delegates of the Companies can represent their work and products and can also give information about their expectations for their future colleagues. A professional excursion is also involved, the main aim of which is to visit many different construction sites located around Hungary. The biggest success every year is the Bridge Modelling Contest.

7.1.2 BME Civil Engineering College for Advanced Studies

The BME Civil Engineering College for Advanced Studies functions as an efficient organization at the Faculty of Civil Engineering at the Budapest University of Technology and Economics, founded in 2004 by 10 self-motivated and committed students. The College consists of 80 members at present and is divided into 5 sections: Section of Structural Engineering, Section of Hydraulic Engineering, Section of Engineering Informatics, Section of Transportation Engineering and Section of Surveying. The main activities are organizing professional excursions, lectures and any other professional events.

7.1.3 IAESTE – Hungarian Group

BUTE has an active IAESTE Group, which brings together students willing to work with companies with industrial problems to tackle. The main aim is to expose students to a professional working environment and to real industrial problems, by a mixture of brainstorming, exhibitions, surveys, posters, and social events.

Further information:

<http://bme.iaeste.hu>

<http://sz7.iaeste.hu>

7.2 Cardiff University

Contact: Alan Kwan kwan@Cardif.ac.uk

At Cardiff, a number of opportunities, some new, some not so new, are offered to students to enhance their interaction with and knowledge of the Industrial scene. One aspect is to involve industrialists directly in teaching programmes, where they give lectures, advise on curriculum content and become involved in design projects, particularly in interdisciplinary aspects.

7.2.1 Careers Fairs

Careers fairs are held in the School, over 2-3 days, when some 40-60 firms come in with their stands and “mingle” with our students. There are also 20-30 evening presentations from companies per year. The main purpose is to showcase their work and examples of exciting projects with which companies are involved, though the Companies also use them as a recruitment exercise.

7.2.2 Development of Practical Skills

Companies are also involved in giving “skills sessions”, showing students real examples of industrial practice. This is good for the students, but also an opportunity for companies to increase their profile amongst the students. Companies also take about 20 students on sandwich placements. This gives students good exposure to real industrial work and excellent opportunities to develop contacts. In addition to these year-long placements, Companies also take students for site visits, though these can be difficult to organise for large groups, and also for summer placements.

7.3 Conseil Nationale des Ingenieurs et Scientifiques de France (CNISF)

Contact: Francois Gerard Baron FGBARON@clubinternet.fr

The contribution from CNISF covers the sector as a whole, and this section outlines activities taking place in a number of French Institutions.

7.3.1 Joint Training in Schools and Companies

Fifteen « Grandes écoles d’ingénieurs », including ENSAIS Strasbourg, Polytechnique Lille, CNAM, SCITC, ESTP, etc have a scheme in which 15 % of their students are educated through a programme

divided between Schools and Companies. After completing their BTS (Brevet de Technicien Supérieur) or DUT (Diplôme Universitaire de Technologies) they are recruited to Grandes Ecoles, but spend half their time in academic education and half in professional education in civil engineering Companies.

Within the Companies, students must attend mandatory training periods in the first and second years, involving work practice, choice of materials and site practice and responsibility. They must also complete a period of training period abroad, very often in Design offices or Companies.

7.3.2 *Les Grands Ateliers de l'Isle d'Abeau* (www.lesgrandsateliers.fr)

This programme, which has similarities to Imperial College's 'Constructionarium' (see below) was initiated by Grandes Ecoles dealing with Architecture, Art and Engineering. Its goal is to develop new studies and educational practices based on approaches with materials, structures, and living space. A number of institutions, including INSA (Institut National des Sciences Appliquées) and ENTPE (Ecole Nationale des Travaux Publics de l'Etat), both located in Lyon, are very active in this. The programme comprises academic studies and practical construction of a structure (or structural element) carried out in huge halls installed in L'Isle d'Abeau (Isère) where models are built, dealing with innovative structural elements built in stone, concrete, wood, textile, and so on. Groups of students undertake the design and the construction, but construction materials and handling support are offered by Civil engineering firms.

7.3.3 *Creative design*

A number of Grandes Ecoles have developed new courses and collaborations which deal with the industrial dimension. Some of these include:

- Common courses between Ecole Nationale des Ponts et Chaussées and Ecole d'Architecture de Marne-la-Vallée
- Development of new courses in eco-design and climatic engineering, ENSAIS (Strasbourg)
- Employment Shows. Grandes Ecoles organize shows, where Civil Engineering firms Design Offices book exhibition space for 2 or 3 days to display their activities and present employment opportunities to students
- Competitions. Some Companies (Bouygues for example) organise a competition between pairs of students, one in civil engineering, one in business, dealing with the design and economics of a structure or building.

7.4 Technische Universität Darmstadt

Contact: Ulvi Arslan arslan@iwmb.tu-darmstadt.de

7.4.1 *Planning, Design and Constructing*

At Darmstadt there is a particular Working Group "Planning, Designing and Constructing", which is responsible for the organization and performance of the orientation of courses within the basic study period in civil engineering and surveying. The courses' ultimate ambition is the students' orientation for the organization of their studies and subsequent field of activity. Through the participation in two different projects planning games the students get the impression of the characteristics of an engineer's project work process regarding the typical organizational structures and workflows. The intent is not only to deliver an insight into the fields of activity of a Civil Engineer or Surveyor, but also to contribute to the students' job qualification and self development. The project planning games simulate typical workflows and demand a thinking in alternatives as well as a readiness to deal with tasks, which are not explained in detail. Therefore the students have to show a high degree of their own initiative as well as the ability to cooperate and to make compromises. In the same time the students' personal skills, like their ability of expressing themselves or of presenting results, are trained. The courses are held as seminars. The students take part in groups of up to 15 participants. The groups are advised by collegiate tutors or research associates. Besides this specialty there are also similar opportunities likely at other universities. Lectures by industrialists,

7.4.2 *Career Fairs and Joint Training in Companies*

These are offered to students to enhance their knowledge of engineering practice. Career Fairs are held at the university over 2-3 days every year in autumn, where many companies and all departments of the university present their work and examples of exciting projects. Further information:

<http://www.konaktiva.tu-darmstadt.de/>

<http://www.elc.tu-darmstadt.de/>

7.5 TU Delft

Contact: Ellen Touw E.Touw@CiTg.TUdelft.NL

7.5.1 BlueDot

BlueDot provides the link between the conceptual work of students and the professional market of consumer products. The foundation functions as a platform and as a label, helping talented students of the DUT by bringing their products to the market. By bringing together the knowledge and experience of both the DUT and the business sector students can commercialize their product and gain valuable experience. The products are produced under licence and sold as Blue Limited University Editions under the label BlueDot. By promoting both the students and their products a more direct link between consumers, companies and students is created. <http://www.blue.tudelft.nl/>

7.5.2 De Delftse Bedrijvendagen

Over the past thirteen years, ‘De Delftse Bedrijvendagen’ has been the best way for students from Delft to establish contact with companies that are of interest to them for possible internships, graduation research projects and job applications. Every year, approximately 1300 students participate; therefore two thirds of all graduating students visit the career fair. This is a unique opportunity to establish contact with Master of Science students of the internationally acclaimed Delft University of Technology. In 2008 102 companies participated in the Presentation Days and all participating students visited this main event of ‘De Delftse Bedrijvendagen’. Because of the success of the Application Training it has been extended to two days in 2008 which allowed 500 students to participate. Most of the In-house Days, formerly known as Workshops, were held at the company’s location, while some took place in Delft. The In-house Days were spread over three weeks so that more students could visit these In-house Days. In total 450 students took part in the In-house Days. Last year, 60 companies participated in the Interview Days, in which more than 650 interviews with 325 different students took place. <http://www.ddb.tudelft.nl>

7.5.3 Techno-starters

The TU Delft wants high-quality research to be translated into hi-tech activity around the university campus. A structural approach is needed to identify and develop this concept, and this is emerging in the shape of a partnership with the market parties: government organisations, businesses and investors. Activities include spin-outs, spin-offs and joint ventures. The TU Delft is particularly keen to offer opportunities to techno-starters demonstrating the potential to build up a structural relationship with the university. [Technosprint](#) was set up to search for potential starters fitting this bill, with the aim of allying them with the university via an incubator function provided by [YES!Delft](#).

The aim of Technosprint is to identify (new) knowledge within the TU Delft, to estimate its commercial value and to pass it on to the business sector. The emphasis is on the transfer of knowledge to (pre-) techno-starters. If this knowledge is to be put to optimum commercial use, a dynamic and sustainable interaction will have to be generated between institutes of knowledge, intermediary organisations and the business sector. All parties will have to make an active contribution in identifying, patenting and transferring commercially useful.

The knowledge acquired in this way will then be conveyed to those market parties in a position to put it to good use. The aim is that all partners in the consortium will act together to bring about more alignment between demand and supply on the knowledge market. Technosprint aims to double the number of (pre-) techno-starters in the Delft region from 15 to 35 per year and to increase the number of inventions/patents from an average of 18 inventions per year to approximately 25. In concrete terms this means that more than 100 new entrepreneurs (techno-starters), 25 new patents and some 30 patent transfers will have been realised by the year 2010.

YES!Delft ,the Young Entrepreneurs Society Delft, , has been set up especially for techno-starters: high-tech entrepreneurs wanting to start their own business. YES!Delft helps techno-starters to overcome or minimise the obstacles facing start-up businesses. Alongside this, YES!Delft also tries to make students aware of the challenges and possibilities involved in starting up your own business.

7.5.4 Internships/ Traineeships

All MSc- curricula offer practical work experience in day-to-day practice of civil engineering companies or institutes (contractors, consultancies, government, non-governmental organisations, etc.) in the Netherlands or abroad. The main objectives are:

- To develop your general engineering skills
- To learn how to apply your technological know-how
- To put into practice any social and communication skills you might have
- To gain a more complete insight into your own particular aptitudes

7.6 TU Denmark

Contact: Jacob Steen Moller jsm@byg.dtu.dk

7.6.1 Student projects with Industry

Students, especially on the MSc programme, are included in research and consultancy work for industry. Typically a company will contact DTU Civil Engineering with a practical problem. The company and teacher of the university defines a thesis or project topic and the students carry out the assignment as part of their study.

7.6.2 Projects in Greenland

Every year DTU sends approx. 40 students to Greenland. The students have identified a number of practical problems suggested by Greenlandic companies or authorities beforehand. During a 3 week summer school in Sisimiut, Greenland they carry out investigations, experiments, monitoring and testing on site in the Arctic environment. The results of the student projects are handed over to the local users and typically a public presentation is given.

7.6.3 Industry Panel

Every 18 month a workshop with is conducted with the purpose of bringing industry, researchers and teachers together to discuss the curriculum and relations with industry. Around 50 industry representatives participated in the last workshop on the topic of University/Industry collaboration. The Department also has a permanent Advisory Board consisting of 5 high ranked industry managers.

7.7. Ecole des Ponts, ParisTech (formerly ENPC)

Contact: Thibaut Szrypek thibaut.skrzypek@enpc.fr

7.7.1 Opening seminars

It is sometime difficult for students to understand finely the stakes and context of the industrial world. In order to make them more receptive to these matters, we have to extract us from the classical rhythm of lessons by organizing one week seminars at the beginning of the year. During those seminars, focused on definite themes, Engineers coming from industrial companies are invited to present specific technologies and to initiate students to their activities. One example is a week-long programme on innovation in concrete, dealing with special concretes such as fibre-reinforced concretes, self setting concretes and laboratory visits, conference-style presentations and quizzes. A second, also a week long, on geotechnical engineering, covers the use of novel techniques, applications, workshops and conference-style sessions

7.7.2 Projects with industrial partners

ENPC organizes projects with industrial partners for small teams of students, based on real case studies. The industrial partner and teaching staff define the scope of the work to be undertaken by the

students, who apply skills and knowledge learned from many parts of their theoretical studies, use professional software, tools and equipments and gain experience of project management at a real scale

An example of this is based on the design of a bridge and simulates the client-consultant-contractor situation, focussing on creativity, conceptual design, calculations and construction. The programme is structured as follows:

- Two sessions for preparation, collection of information, including site visits
- Five sessions on conceptual design and calculations
- Five sessions on detailed construction methods and procedures
- A final session presenting the results

In the final presentation, the students outline the range of options, justify the one they have chosen, set out their calculations and describe the construction methods they use. They must also submit drawings.

7.8 Ecole Supérieure des Travaux Publics, du Bâtiment et l'Industrie (ESTP Paris)

Contact: Marie-Jo Godaert goedert@adm.estp.fr

7.8.1 The ESTP Construction Fair

This is a student-led activity. Each year, the Students' Union organizes a "Construction Fair, in which they rent an exhibition hall and sell exhibition spaces to companies. In 2008, 120 exhibitors participated at "Paris Porte de Versailles Exhibition Hall", to present their company and its activities and to recruit students for internships and first jobs. Entrance is free, attendance around 4.000 visitors, mostly civil engineering students from all over France. A cycle of conferences complete the exhibition space. Each year a VIP such as a government minister inaugurates the Fair. Apart from the obvious benefit for the visiting students, this event represents an excellent training in management for the organising team.

7.8.2 Professional days as part of the curriculum

During the academic year, 6 lecture free days are scheduled in order to allow students to meet and interact with companies. Each day is dedicated to particular themes, for example, environmental engineering, real estate management, health & safety, quality management, transportation, energy and so on. The days incorporate events such as conferences, presentations, site visits, mock job interviews, and give students excellent opportunities to make contacts.

7.9 Helsinki University of Technology

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7.9.1 Getting to Know the Industry

The relationship between students and the Industry at HUT has traditionally been cultivated very actively and both parties welcome this versatile co-operation. Co-operation starts at the beginning of academic year and continues throughout the studies. Students get some preliminary knowledge of the demands expected of them, form contacts to the professional world and get some impression of real working life. The industrial side will learn about students as potential employees and get also some information about the university practices and syllabus. Very often this fruitful co-operation will be deepening during the student days already, by various traineeships in the summer and Christmas holidays. The common symbiosis often culminates in the MSc- or Diploma-thesis which often involves industrial sponsorship and tuition.

The collaborative companies welcome the freshmen during their first weeks in many events, for example during the distribution of students' overalls and sports day.

7.9.2 Uniforms

Overalls are one of the characteristics of engineering students along with the technology student cap. Similar appearance brings students of the same study program closer together, as different study programs have differently colored overalls. On the second day of autumn semester every year, the

freshmen get their overalls. One of the major Construction Companies donates the overalls and the representatives come to help with the distribution and a manager give a speech about the importance of studies. At the end, students toast for their studies and co-operation with the Company.

7.9.3 Social Interactions

The Guild of Civil Engineers has traditionally promoted interaction between students and industry. It is an active subgroup of The Student Union of HUT. The Guild, founded in 1913 has a long and distinguished history and a membership consists mainly of students of Structural Engineering and Building Technology and Transportation and Environmental Engineering. It plans and organizes parties, excursions, theatre visits, sport events and other events for its members, with many of these activities designed especially for the freshmen. The guild also manages publicity, having an influence on study matters and informing about them. These activities are made possible with the help of Finnish Construction Companies, Industry and Associations.

Sports day is organized for the freshmen a few weeks after beginning of studies. It is financed by another major Construction Company. During the sports day, a group of freshmen go to a forest to play paintball with the representatives of the company. The evening continues with dinner, during dining the students get to hear more about the Company. As always in the Guild events, there is also a possibility to go to sauna and discuss topics of mutual interest in a more relaxed manner.

7.9.4 Real Life Bridge Design and Competition

Another approach used at HUT is to use the Masters Thesis as a vehicle for analysis of a real problem of current interest and importance. One recent good example considers the load carrying capacity and service life of Brandostrooms bro suspension bridge. A detailed exercise is set out involving general design of a simple two-lane reinforced concrete girder bridge with abutments founded on rock or soil.

In spring 2007, a design competition between the Bridge Engineering students at TKK was arranged for constructing a real bridge over a small pond on the backyard of the Civil Engineering building. The five-member jury consisted of the Professor, a bridge design engineer from a consulting engineering company, another bridge engineer representing a contractor firm and two student representatives, one from Civil and one from the Architectural Department. Altogether 12 proposals were left in. To the designers of the three best proposals were awarded a prize: 2000, 1000 and 500 Euro, respectively. The money was provided by the industry. The quality of the proposals was surprisingly high considering that the participants were the third and fourth year students. All three winning proposals were prepared by the fourth year students, which indicates that one year more studies clearly gives advantage in such design competitions.

In another example, A 50 years old suspension bridge was load-tested and analysed to assess its load-bearing capacity and remaining service life. The project was carried out by a final year student as a Diploma Work (Final Project) study completed in April 2008. The instructor of the study came from a private enterprise responsible for the investigation. It was an excellent opportunity for the student to become acquainted with real problematic of a relatively big suspension bridge (main span 98 meters). The abstract of the study is enclosed (Enclosure 3).

7.10 Imperial College London

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7.10.1 The Constructionarium

It has been recognised for some time at Imperial that undergraduate students, although academically very able, have little experience of or skill in working with hand tools and therefore little understanding of how to go about the task of building a physical artefact. To address this perceived deficiency, a one-week field course - The Constructionarium – is held at the end of the second year. With support from construction companies, teams of students are required to construct, safely, efficiently and economically, a reduced-scale version of an existing design. Further details are given in the 2 attached files and web link below:

<http://www3.imperial.ac.uk/pls/portallive/docs/1/16645697.PDF>

7.10.2 Industrial Contributions to Creative Design

Imperial has recently appointed as Adjunct Professor of Creative Design the Director of Structural Engineering of an International firm of consulting engineers. Design is an essential thread that must run through all stages of an undergraduate course and the best way of ensuring that students are excited and inspired by exposure to real engineering design is considered to be through the involvement of leading professional practitioners working together with academic staff. The new Professor has developed a course base on practical project work which gives a clear impression of all the issues that influence design decisions at the conceptual stage. The course is tutored as studio work by 6 young engineers from the Professor's company, together with a matching number of academic staff. Funding for the course is provided jointly by a charitable trust associated with the company and my Imperial College. Further details are given at:

http://www3.imperial.ac.uk/newsandeventspggrp/imperialcollege/newssummary/news_31-3-2008-14-56-27?newsid=32134

7.10.3 Meet the Industry

Every year we organise an evening event with about 20 of the leading civil engineering companies coming to the College to meet our students. They bring the sort of display stands and literature which you would expect to find at a conference or exhibition. The event is partly social and partly a networking opportunity and it gives the students the chance to talk to companies about the type of work they do. It is not a recruitment event as such, but students do take the opportunity to get to know about companies, which is a great help to them when they come to the time to look for jobs.

7.11 Institut National des Sciences Appliquee (INSA) Lyon

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7.11.1 Promotion of a Class by a Company

In 2008-2009, each of the class of the Civil Engineering Department will be promoted by a French company or organization (GFC construction, SCET and Maia Sonnier)

The program includes:

- Internships that are offered to the students (approximately 10 % of the class, i.e 10 students)
- Simulation of job interviews (performed by the company Human Resources representatives),
- Site visits (at least 2 during the academic year, duration 1 day each, for the whole class)
- Participation in the cycle of "Conférences métiers".

7.11.2 Cycle of "Conférences métiers":

Managed by the Civil Eng. Dept. student association, a series of 7 to 8 conferences are organized throughout the academic year (one every 3 weeks). Representatives of several companies (generally 3 per conference) and "young" alumni participate in these 2 to 3 hours conferences aimed at presenting one specific aspect of the Civil Engineering. Therefore, these conferences illustrate the wide panel of possible future missions and jobs for the students.

7.11.3 Final Year Integrated Project

During the final year of studies, students can choose, in addition to their final year research project, a so called 'Technical Project' in three different majors; Urban Development, Building and Public Works. Every year, more than 30% of the students choose the Building project. This is run with the Lyon School of Architecture in groups of 3 + 3 students, and aims to integrate the different disciplines for the solution of a single problem, moving beyond technical design to general design and taking into account architectural, sociological, societal and economic considerations, as well as technical aspects. A group of academics and professional engineers and architects guide the students throughout the project that spans over one semester (50% of the semester is dedicated to the project). The 2 other options (Urban development and Public works) also propose this type of technical projects with interventions of professional engineers. Full details of the project are given in a paper presented to the

1st International Conference on Education and Training in Geoengineering Sciences held in Constantza - Romania, June 2nd – 4th, 2008.

7.11.4 Design and Materials

In 2005, INSA Lyon created “Transversal Options”, corresponding to courses of 100 hours that all final year students of INSA can select. One of these is called “Design and Materials”, which relates design ideas to practical construction and manufacture. The objective is to approach problems of design while taking into account real-life constraints such as the market, issues concerning the manufacture and use of materials, and constraints of the construction process. The project involves a strong industrial contribution and has three phases; analysis of existing concepts, a study of construction and manufacturing aspects and the actual construction of models and prototypes, including workshop and foundry operations. During the allocated time, students work on the design and production of a prototype of a Civil-Engineering related artefact. The students work together with an industrial company who would like to produce and commercialize the resulting object.

7.11.5 Grands Ateliers

The Civil Engineering Department of INSA Lyon participates in this innovative structure already described in the contribution of CNISF.

7.12 Laboratoire Central des Ponts et Chaussées, Paris

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7.12.1 Industrial Input

The Laboratoire Centrale des Ponts et Chaussées, as an industrial laboratory, does not offer study programmes, but it does collaborate closely with Grandes Ecoles to offer an engineering formation which is geared to the needs of Industry. They make an important contribution in hosting students for final year project work, where the specialist equipment and facilities of the Laboratoire are made available to the students and are much appreciated by them. They are also involved in creative approaches to design, particularly in terms of providing architectural expertise and opportunities for students to meet industrialists, see their work and discuss possibilities for employment

7.13 Institut Supérieur du Bâtiment et des Travaux Publics (ISBA-TP), Marseille

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7.13.1 The Syntec Congress

This is an annual meeting for the Engineering professionals, recent graduates and students from 60 engineering schools, organised by Syntec-Ingenierie. It comprises professional workshops on key current topics, such as globalisation, innovation, sustainable development and double training as architect-engineer and debates on topics such as "The place of the women in the engineering", "E-recruitment", "the young graduates and the international scene", etc. These always prove to be highly successful because of the mix of topical subjects and top speakers. The congress also holds a competition, Engineering of the Future, which invites student-engineers to forecast the future by thinking about the possible evolution of sciences and technologies up to 2020. The plenary session always deals with a key general topic, a recent example of which (September 2007) reported on a study of the evolution of the Engineering market and prospects for investment and growth in the coming years. The format of the conference also allows students to meet company representatives to discuss career prospects and opportunities.

http://www.syntec-ingenierie.fr/fr/evenements/rencontresdel8217ingenierie/rencontres2007/programme_5p.pdf

7.13.2 Curriculum Development for Industry

One of the best ways to understand what Industry expects from academe is for industrialists to be closely involved with defining and developing curricula. The School in Marseille is "owned" by a Chamber of Commerce and the vast majority of the teachers are professional engineers working in companies. This means that they are in a position to ensure that the curriculum is finely attuned to the future needs of Industry.

7.14 Middle East Technical University (METU), Ankara, Turkey

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The Construction Industry contributes to the educational activities of the universities only through indirect channels, a number of which are described below.

7.14.1 Accreditation Related Questionnaires

This Department has been accredited by ABET twice in the past and currently is preparing for the third. Input of the Construction Industry is essential in the revision of the course contents to take account of their needs and wishes in shaping the Engineer of the future. Furthermore, it is essential to get the feedback from the employers about the performance of the earlier graduates.

7.14.2 Capstone Design

Experienced practicing engineers actively participate in the instruction and supervision in this compulsory course. Furthermore, design problems assigned every year are usually chosen from the actual practice to familiarise the students with the facts of engineering life.

7.14.3 Hydro-Power Engineering Centre

High level experts from the industry take part in the development and instruction of the related courses, besides participating in planning and execution of research in this particular field.

7.14.4 Technical Electives Given by Practicing Engineers

Several technical elective courses are given by part-time instructors who are experienced practicing engineers.

7.14.5 Summer Practice

This is an old fashioned but rather effective activity leading to direct involvement of the students in the actual engineering practice.

7.14.6 Extracurricular Student Activities

Students often organise various activities bringing students and potential employers together, such as lectures, dialogues, career days, student competitions etc. Some of these may be comprehensive enough to accommodate one or two small workshops involving academia and high level managers from industry.

7.14.7. Collaboration in Research and Technology Development

Universities and leading companies collaborate in performing research and technology development to a certain extent. This research is predominantly experimental, and it generally concerns a specific problem brought by the industry. Universities provide the know-how, research manpower and research facilities and the companies provide finances.

This kind of collaboration has recently increased significantly both in extent and in content after the participation of the country in the Framework Programmes (FP6 & FP7) of the European Union, since most of the programmes require an extensive collaboration of the academia and the industry, including SME's as well as large companies.

Most of the leading universities have established their technoparks in the last 5-6 years, and the advantages a tecnopark presents encouraged the faculty and the companies to further their collaboration in research and technology development.

7.14.8 Consulting

Construction companies knock at the door of the university whenever they need the expertise of the faculty to rescue them from the problem they are facing, usually a problem caused by their deficient engineering practice. It is usually so urgent that the report they require is already overdue. However, putting the joke aside, this is a very important and effective channel of university-industry interaction. It is extremely beneficial for both sides. Industry usually finds an effective and economical solution to its problem, whereas the faculty is kept in contact with the engineering practice so that they are not isolated in the ivory tower. Furthermore, nobody can complain about a small extra income, especially if the professor is getting “celery” instead of a decent “salary” as in the case of Turkey.

7.15 Fachhochschule Oldenburg (now known ad JADE Hochschule)

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7.15.1 Industrial Placements

In Oldenburgh, much use is made of placement in industry during the 7th semester of the Bachelor degree. Students have a placement in a company, either a contracting firm or a design office, during which they gain a lot of practical experience. This programme operates as a joint one between the Fachhochschule and the Company and involves a very close cooperation between them.

7.16 University of Pardubice

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7.16.1 AIESEC (Association Internationale des Etudiants en Sciences Economiques et Commerciales)

This is a very large organisation which operates as a platform for young people to develop their potential. Member organisations come from all sectors of economy. In the Czech Republic, AIESEC has 9 national offices, one them being at the University of Pardubice. It is operated and managed by the students and operates as a consulting centre, organising regular sessions to inform students about Czech and foreign companies. Further information is available from: www.aiesec.cz

7.16.2 Kontakt

This is an event organized by the University of Pardubice (Faculty of Economics and Administration). Its aim is to provide topical information about the Czech labour market. It is organised annually and takes the form of a trade fair. Businesses present their activities and achievements using presentations and display stands, informing the students about job opportunities. Students have no lectures on this day to be able to visit and meet their potential future employers. Further information: www.kontakt.upce.cz

7.16.3 Best Diploma Paper

Every year the Faculty of Transport organizes a competition “Best Diploma Paper”. Final paper topics are consulted and then “officially announced” in cooperation with construction companies and other businesses involved in civil engineering who then assess the papers in terms of their applicability in practice. The best papers are then rewarded by the companies.

7.17 University of Patras

Contact: Stephanos Dritsos dritsos@upatras.gr

7.17.1 An Innovative University-Industry Interaction

Every year a Student Conference is organized in the conference centre at the University of Patras, where students present their projects performed in the subject area of Retrofitting Existing Structures. This is a particularly relevant topic for the seismic region of Greece as past earthquakes have

demonstrated that a substantial proportion of the existing building stock is structurally deficient. Presentations at the Conference represent the most up to date thinking in the subject area. The Conference is announced to the local industry and practicing engineers and is supported by the Greek Association of Civil Engineers and the local branch of the Technical Chamber of Greece. The three main steel production companies of Greece subsidise the Conference. The Conference is attended by students and practicing engineers from the local region and it is to be noted that the latter actively participate in discussion after presentations.

A Conference hard copy and CD proceedings are given to participants. All presented papers are reviewed by a three member committee and prizes are awarded to the four best projects. Two prizes are awarded by the Greek Association of Civil Engineers while the other two are awarded by a private software company. From six to eight papers are selected for publication in the practical application based Greek Civil Engineering Journal. The criteria for paper selection is on the basis of the most relevant subject matter covering grey areas of knowledge that would be of most use to practicing engineers. All Conference papers are uploaded on the website: www.episkeves.civil.upatras.gr. This website is regularly visited by industry and practicing engineers and is the website of choice in the recovery period after a destructive earthquake, since information on the subject matter is limited exactly at the time when it is in most demand.

Everybody benefits from the University-Industry interaction through the Student Conference. Practicing engineers are kept up to date with the most recent developments, are able to compliment their past education and are made aware of a unique source of information while students have their work constructively criticised particularly in the light of experience and practical application.

7.18 University of Pisa

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7.18.1 Degree and Profession

This is an opportunity for graduates to meet the professional world and to promote new ideas in Architecture, Engineering Environment, Art, Fashion and Design. It takes place at the Florence World Festival (*Festival Internazionale a Firenze*) and is organised by the Romualdo del Bianco Foundation

Further details:

www.florence-expo.com

INFO: tel. 055 285588 - www.florence-expo.com, info@florence-expo.com

7.19 Universidade do Porto

Contact: Alfredo Soeiro avsoeiro@fe.up.pt

7.19.1 Strategy for the Bologna Process

Due to the implementation of the Bologna Process in Europe the Civil Engineering President, Prof. Ferreira Lemos, decided to create a reflection group of eight members. Four were teaching staff from the school, including the president and the academic dean, and the other four were from industry. The members from industry were from recognized institutions and organizations reflecting the wide scope of civil engineering jobs and activities. A plan was devised on the first meeting defining the scope and pace of the group work. During three months meetings were held and the conclusions discussed using email. The conclusions were directed at proposing a suitable organization of the first and second cycle degrees according to the Bologna process and the future needs of civil engineering. The reasons and conditions for the proposal were also presented in the report. The document was then used for the debate with the rest of the academic staff and for the adoption of the model currently in place. It was a very rich source to evaluate the perspectives of industry about the education expected from the civil engineering school and the knowledge, competences, attitudes and skills from first and second cycle degree holders.

7.20 Czech Technical University, Prague

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7.20.1 Student competition: "Hall of the Year"

The competition is organized annually in two categories: Hall of the Year “Academic”, for students from home and abroad and Hall of the Year “Junior”, for students from secondary professional schools

The aim of the competition is to design and construct the lightest structure of a hall with a given span, subjected to prescribed constraints, using one of three materials, wood, paper and beer mats. Wood and paper models are fabricated in advance, while models made from beer mats are made partly during the competition. The strength of the models is determined by load tests. Progress of destructive tests is monitored using a high-speed camera and concurrently presented by moderator-specialist. Winners receive valuable prizes offered by companies and other sponsors. As a part of competition, the exhibition of the models and associated technology is organised, alongside exhibits and multimedia presentations from and about the partner companies.

Video presentations:

part 1: <http://www.youtube.com/watch?v=y6wpy6rq3XY>

part 2: <http://www.youtube.com/watch?v=o3BcWmBk4js>

part 3: <http://www.youtube.com/watch?v=c1xWH5bOKkw>

7.20.2 Programme for Promoting Industrial Talent

Faculty of Civil Engineering in Prague (FCE) has many useful contacts with renowned design offices and with small to big contractors operating within the Czech Republic. One of the most effective collaborations is with the building Company METROSTAV, one of the biggest companies in the sector. For a number of years, Metrostav and FCE have run a competition for posts for student training within the Company. Concurrently with their studies, the students work at the Company for reduced salary, receive experience and skills training and, prepare his/her diploma project under the supervision of an experienced industrial supervisor. Typically 35 new students enroll each year, giving a total operational cohort of about 100. The training programme is highly appreciated by students, as shown by the ration of applicants to acceptances of 3:1.

The Company accepts students from both Bachelor (with the exception of 1st year students) and Master Studies programmes. The competition is based on academic performance and motivation. The training programme includes the following criteria:

- short/long term training at various positions,
- possible focus on diploma project,
- consultation with Company’s professionals,
- allocation of personal supervisor and receiving experience from various fields,
- possibility to receive permanent job after graduating, respecting the training period,
- interesting and demanding work concerning unique structures.

7.21 Riga Technical University

Contact: Juris Smirnovs smirnovs@mail.bf.rtu.lv

7.21.1 Career days

Starting in 2004., Riga Technical University, in close co-operation with industrial companies, has organised “Career days”. During these events companies are able to meet and talk to students about job opportunities and what the companies are doing, while students have good opportunities to meet company representatives and begin to make contacts in the profession. This often leads to practical placements for students during their university studies, as well as jobs afterwards. In “Career days - 2008” 47 big companies took part, part of a growing trend for increased levels of involvement. The “Career days” also include high level discussions between company managers and the senior management of the University. These events are a common feature of the university, also taking place in other Faculties. Further details can be obtained from web link below:

<http://www.rtu.lv/content/view/522/1029/lang/>

7.22 Escuela de Caminos de Santander

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7.22.1 IDEaS (Integración en la Docencia de las Empresas del Sector de Construcción en la Escuela de Caminos de Santander) - Incorporating Construction Companies' Teaching into Santander Civil Engineering School

The IDEaS program aims to enhance students' training by orientating it towards their incorporation to Construction Industry and to reinforce links between the School and Construction Sector. Leading companies are invited to offer courses with similar content to the training modules they give to their professional engineers. During a period of 6.5 weeks, each Company gives a course on topics such as Management Systems in Construction, Initial management of Construction Works, Construction Works Control, Construction Works Planning and Studies, New Technologies in Underground Construction or Building Concrete Structures. Courses are offered as optional or elective credits (in a range of 2 to 7.5 credits per course) as a part of the final year of study, and also include site visits. The program is complemented by five-month professional internships in the Companies, within the Spain or abroad. During this period students are encouraged to develop their Final Project or equivalent technical work.

7.22.2 ENEIC (Encuentro de empresas de ingeniería civil - Meeting Civil Engineering Companies)

Every year students organize a two-day meeting of the professional sector in the School, to provide students with an overview of career options and to get them closer to the professional world, facilitating their future employment. Civil Engineering Companies, Professional Institutions, University Research Groups and local Administrations are invited to present their activities within an intensive program of short talks, a specific publication that gathers descriptions of all participants in the meeting, and through personal interviews with the students that visit their exhibition stands. Students' attendance and active participation in the meeting are acknowledged as elective credits.

7.23 Technological Education Institution, Serres

Contact: Errikos Mouratidis erikm44@hotmail.com

7.23.1 Industrial Training

During the last (8th) semester of their studies, students undertake a 6-month practical training placement in the public sector or a private company. During this period, many are occupied in building sites, where they gain experience and develop skills in working with hand tools, while others work in design companies, also gaining experience which they do not get from their university studies.

7.23.2 Design Dissertation

At the end of their studies, students present a dissertation thesis supervised by professors and specialists, the basis of which is the complete concept and design of a special structure. Students have to start from land surveying, deal with the relevant authorities, learn the building legislation, conceptualize and design the structure, solve specific problems, draw up the budget and the organization of the building site. The whole project has to be based on the knowledge obtained during the students' studies, and a research aspect is also required.

7.223.3 Interaction with Professionals

Once a year, professionals (graduates of the Civil Engineering Department) are invited to present information about their professional work to the students, discuss with professors about the difficulties they had when they started working and give suggestions about improvements and developments of the curriculum. During these sessions, students have the opportunity meet professional engineers for discussion and advice. The Careers Office is also involved and organizes similar events.

7.24 Tallinn University of Technology

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The mission of the University is to support Estonia's sustainable development through scientific creation and science-based higher education in the field of engineering, technology, natural and social sciences. In response to its mission statement, the Faculty of Civil Engineering has established a number of different examples of co-operation with Industry.

7.24.1 Industrial Representation

In the Academic and Departmental Boards there is a long tradition that the external members are invited from different Companies or Professional Institutions within the Sector. On the one hand, it gives publicity to the decisions and discussions within the University, while on the other hand the representatives of Industry can address their problems directly to the academic staff. Of course, at the same time the academic staff are also involved in different decision-bodies formed by the Industry. In parallel to the direct links with the business community there are also the advisory links between the Faculty and the relevant Ministry (of Economic Affairs and Communication) responsible for Construction Sector. In practice this means that academic staff are involved when legislation is drafted and that they participate in all the working commissions of the National Standardisation Board.

7.24.2 Guest Lectures from Alumni

It is common for former students of the Faculty to be invited to give guest-lectures. They are also involved when the topics for MSc theses are proposed – the idea is that the majority of the topics of the theses should be industry based.

7.24.3 Cooperation Agreements

TUT has introduced the practice of signing co-operation contracts with the advanced companies from different Industrial Sectors. These contracts foresee various forms co-operation, including research and testing, but also possible Company sponsorship, which is mainly used to invest into equipment used in the laboratories of the University. Currently there are three contracts of this type signed between the Faculty and Companies in the Construction Sector, providing equipment and scholarships.

7.24.4 Careers and Company Awareness

The Faculty also organises meetings with the leading Companies, in which representatives outline its activities, work practices and working conditions to students. This is similar to a number of other institutions, although on a smaller scale, involving only 1 - 3 companies. The Faculty also has a number of co-operation agreements with some companies the most recent being the Frame Contract with AS SWECO, a 4 year agreement in which the company guarantees practical training for students and provides a fund for scholarships.

Still one has to keep in mind – the success of construction sector is greatly dependant on the general economic climate. When the economy was booming the companies of the construction Industry could easily provide placement for the graduates and training possibilities for the students. This situation has changed by today, but these traditions will be continued, for sure. In ‘good’ times about 85% of students were working in the Civil Engineering Industry. This, of course, had its negative feedback to the academic performance of the students, but gave immense practical experience that has been successfully used during the academic studies.

7.25 Universitatea Politehnica Timisoara

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7.25.1 Building Technology in Practice

Within the field of Building Technology, part of the lecture programme is provided by companies and is based on the requirements of site work. It includes material on site organisation and also gives students the opportunity for site work for students. Responsibility for the module is shared between the University and the Company, with staff from both playing a prominent part.

8. NATIONAL ‘STATE OF THE ART’ REPORTS

For this section, national representatives were asked to submit reports outlining the current state of the interaction between Industry and Academe, based largely on existing material rather than on further surveys. The idea here is that in most countries, there is already in existence a significant literature covering this topic, which has been compiled by technical and educational journalists, Professional,

Industrial and Government bodies and other interested groups, and it is therefore not necessary to undertake further studies. Rather, it should be quite possible to understand the current situation by looking at and summarising the existing literature. All countries were asked to submit material, in a standard format, comprising sections dealing with skills shortages, quality and standards, the role of government and the current economic situation. Replies were received from the following countries:

Czech Republic; Denmark; Germany; Finland; Greece; Italy; Poland; Portugal; Turkey; United Kingdom

The key points raised in these reports are summarised here and the full reports are available in Appendix 2

8.1 Skills Shortages

(CZ) Staff/skills shortages are seen as an ongoing problem and a limit to growth, particularly in areas such as building, project managers, contract managers and craftsmen, including carpenters, building services and electricians. The total figure is as high as 5000. The problem tends to be tackled by bringing in workers from other countries, which is fine for CZ, but simply moves the problem elsewhere. The key reason remains the relatively small number of students who wish to study for technical professions.

(DK) For many years, unemployment for engineers has been very low, and there continues to be a shortage of personnel, especially in road and rail building. Other shortage areas include civil works and infrastructure planning, climate adaptation, and energy in buildings. Recent studies suggest that provision of trained engineers will be satisfactory in the coming years, with the Public Sector actively seeking to attract engineers again.

Industry complains that the output from universities is too small, but the key limiting factor here is the willingness of students to enrol in technical courses. One recent approach has been to develop a scheme of industrially supported PhD grants as a mechanism to attract the best students and raise the profile of the Industry. This seems to be working well.

(GR) Greece has traditionally had an oversupply of graduates for industry, due to the high esteem in which an engineering qualification is held. However, there is an increasing belief that courses are too long, not sufficiently vocationally-orientated, and that graduates are often over-qualified for the jobs available. Thus there is a strong feeling that university curricula need to change. More emphasis is needed on law, business and management, as well as some 'non-classical' areas such as energy and environment

(P) Internationalisation means that employment levels for Portuguese engineers are good at present. Supply and demand are reasonably well in balance, and unemployment seems to be limited to graduates of the less highly-regarded universities. Demand for places on engineering courses remains high and the profession remains well respected as a quality profession. .

(UK) The UK has Industry has also experienced skills shortages over a number of years, and a time when the workload of the Construction Sector is very high (Olympics, Crossrail etc) this is a significant problem.

8.2 Providing the Missing Skills - The Skills Pipeline

(CZ) Although graduates are now considered to be more independent and self-confident, they are still considered to be lacking in communication skills and knowledge of law and business economics

Training needs (DK) are generally covered by the provision of CPD within the Industry, with the University sector providing training in fire design, construction planning and business management. Areas where skills enhancement is needed include energy efficient buildings and facilities management.

(DE) German university professors are quite distanced from undergraduates, focussing their main interests on Lehrstul (research groups). The situation is better in Fachhochsule, though here, the

problem is different, with many students and not enough staff. The split in the sector is quite clear, with Universities focussing on R and D, the Fachhochschulen on professional requirements.

Placement problems are increasing, which means that it is more difficult for students to get the industrial experience which the sector says it needs.

There is a downturn in numbers coming into the Industry, due to the reduction of students wishing to study technical subjects, perhaps due to negative headlines about the reduction in building activity. The consequences are clear, with companies finding it increasingly difficult to recruit the people they need. This lack of qualified personnel is likely to have a detrimental effect on economic growth.

(GR) Numbers of students wishing to enter civil engineering studies are bearing up well, and civil engineering is still highly regarded as a profession in Greece. However, the type of employment on offer is now changing. Large scale spending as a result of the Athens Olympics and EU investment has now fallen and there is a growing tendency for short term employment contracts and a feeling of insecurity.

(IT) In Italy, production of graduate engineers seems to be sufficient for current needs, and most new graduates do go on to establish themselves in the profession, albeit perhaps not earning the level of salaries they feel they should. This suggests tht the Italian labour market is not as competitive as in some other countries.

Computing, languages and a solid preparation in the key technical subjects are required, but the need for PG qualifications is considered to be low for labour market requirements, even though many students wish to study at PG level.

However, the numbers of pupils entering universities is falling, though engineering figures remain stable.

(T) Civil engineering is not so popular with young people wishing to go to university, probably due to perceptions about salaries and working conditions. In addition, students are often placed in programmes which they have not chosen, meaning that many engineering students are not following a subject of their own choice.

(UK) In the UK, one of the key problems is getting young people interested at a sufficiently early age, which will allow them to make the right subject choices at school. The image of the Profession is also something of a problem. Many other professions are considered to be much more attractive by young people.

8.3 Quality and Standards

In a number of cases, questions about the standard of graduates students entering the Profession have been raised, as well as whether standards of professional work are as they should be in all countries.

(CZ) Pressure of work and shortage of staff are leading to corner-cutting and a falling off in the standard of work, leading to suggestions for enhanced quality management procedures for the Industry. There are ongoing discussions about the need to tackle this problem with a programme of CPD.

(DK) A programme of national accreditation was introduced in 2007/8. This is putting considerable strain on resources in Universities and it is still very doubtful whether the process will lead to an enhancement of quality.

(P) The system for quality and standards is considered to be effective, with the Ordem dos Engenheiros operating well and ISO now well established in the Industry. Where they do occur, problems tend to be found in small building companies rather than civil engineering firms.

(T) Quality needs to be increased. The number of under-educated and barely adequate engineers is worryingly high. The Chamber of Engineers is working on this, and continuing education is seen as one way forward, even to the extent of making it mandatory for the renewal of an engineering licence to practice.

(UK) In the UK, standards are broadly considered to be good, but there is some concern that this is not uniform across the sector.

8.4 The Role of Government

Perhaps not surprisingly, the role of Government in financing universities is considered a key topic, along with its role in providing a stable economic and regulatory environment in which the Sector, both academic and industrial, can operate.

(CZ) The Government's main role concerns finance. Universities are facing a significant financial crisis in the Czech Republic, which will lead to cutbacks, redundancies and closures, with concomitant effects on the output for Industry.

(P) A charge of 0.5 % of the contract value is now being levied on companies which win government contracts, to be invested in research. This could be extended, with other companies investing the same amount in universities, for mutual benefit. A good idea, but how likely is it to come about?

(T) Universities have been established without provision of suitable staffing and infrastructure levels.

The industrial and infrastructure requirements of the country are still far from being met, so the need for engineers will continue. Seismic retrofitting is important here, though only part of the story. Substandard work is considered to be a problem in the Industry, though not as a result of the education system. Thus, is there a role for Government in controlling this? Working with Industry?

Avenues for enhanced collaboration include the development of technoparks, and enhanced opportunities for academic staff to undertake consulting for industry, both to solve problems and to enhance mutual understanding.

(UK) One of the main concerns in the UK is for the Government to provide a stable planning, legislative and regulatory platform for Industry, which will enhance long term investment. The University sector would also like to see a stable and sufficient level of funding for Civil Engineering education, though it recognises that this is unlikely to be achieved in the current economic climate.

8.5 The Role of Industry

(CZ) There is also a belief that they are not really ready to make an immediate contribution to the industry, because of lack of practical and work-related preparation (whether this is a valid criticism by Industry of new graduates is another matter). These problems are considered to be due in part to the lack of practical experience and orientation of university staff

(P) Student fees levels are seen as a type of subsidy for Industry, with universities seen as a source of cheap labour. This makes Industry less inclined to get involved with the University sector. This general view applies less to PG work, where University-Industry cooperation is more common.

Companies do not invest in research, which is seen as a cost, not an investment. This means that PhD qualifications are not recognised and respected

Industry needs to demonstrate a willingness to accept incompletely prepared graduates. The University Sector can educate graduates in the key fundamentals of engineering science and develop some key skills in the students, including IT, communication, critical thinking and a problem solving attitude. It can also inculcate an 'engineering state of mind'. However, it cannot produce graduates who are always expected to operate effectively as an Engineer from day one. There is a strong need for Industry to provide the sort of detailed specialist training matched to its needs and probably much better provided on the job. The need for this life long learning has now been widely recognised. Obvious examples of this might include construction logistics, project management, full-life costing, civil engineering as a business, professionalism in working life, etc.

(UK) One of the key issues is the need for Industry and Academia to work in a complementary way. Each has a vital role to play in the formation of Engineers. The first provides a sound education in the

fundamentals of engineering science and instils an attitude of creativity, problem solving and what is termed an 'engineering state of mind'. The second is where the well-educated by inexperienced graduate learns about real engineering logistics and applies his or her knowledge in the solution of real engineering problems. Both parties can do more to work together on this.

8.6 The Current Economic Situation

The survey was conducted very shortly before the economic downturn hit Europe hard in the fourth quarter of 2008, so this section is not really an up to date account of the fate of the construction sector across Europe. Nonetheless, some interesting points arose which are noted below.

(CZ) Although 2008 saw a decrease in the number of government contracts for civil engineering, their total value was higher, a pleasing development. However, more recently, there has been a significant downturn in domestic and commercial building programmes and particularly in civil engineering infrastructure programmes, especially roads and traffic.

(DK) Denmark has seen a considerable down turn in home building, with staff being laid off, but there is still the recognition of the need to carry on with large infrastructure projects which are currently under way, including road and rail projects.

(DE) forecasting demand is very difficult, due to the economic situation

(GR) Within Greece, both the public and private sectors are now facing difficulties as a result of the economic downturn. The immediate future looks tough, but more optimistically, it might be seen as a good opportunity for the sector, particularly the university part, to make a shift away from some of the more traditional and classical topics towards those which are likely to be more necessary for the future.

(P) In Portugal, investment in public works is seen as a way out of the economic recession. However, investment in universities is falling, which suggests that they must seek other sources of funding to maintain their positions.

(UK) Construction is being hit hard, but at the present time, the impact is more significant for building than for big civil engineering infrastructure projects, some of which, such as the Olympics, have major national significance and prestige, and as such, are not likely to be cancelled or slowed up. However, some private organisations are taking decision to defer major projects if the relevant planning cycle permits.

8.7 Other Points

The openness (or otherwise) of the EU to the mobility of professionals is considered to be a problem, both in terms of non-EU people seeking work in the Czech Republic and Czech citizens being able to work elsewhere in the EU, especially in Germany. This is a matter for the Profession and the Government to tackle.

(DE) Following the introduction of the Bologna Process, there is some doubt about whether first cycle graduates (Bachelor) are suitably qualified for the job market, with students themselves also feeling the same uncertainties. This of course is exactly the opposite of what the Bologna Process is trying to achieve. However, recruitment statistics suggest that students are happy with the Bachelor system. There is clearly a conflict here.

(IT) Italian engineering education does not link in well with the perceived needs of industry, especially at first cycle level, and qualifications, especially at PG level, and not widely appreciated by the labour market.

(P) Civil Engineers are not good at presenting a positive image of their profession. This needs to be improved and would presumably have the spinoff of raising profile amongst

9. QUESTIONS AND TOPICS FOR FURTHER STUDY

During the final stages of the compilation of this report a number of important questions related to the main topic of this report arose. It was not possible to review these in detail because of the constraints of time, but the General Assembly did debate them and a brief summary of the prevailing views are given below.

9.1. The Bologna Declaration

Does the Bologna system actually produce graduates at the first cycle who match the needs of the labour market?

At the time of writing (December 2009), this remains a very open question. Within Civil Engineering education, there is still a lack of compliance with Bologna and a strong feeling in favour of national traditions of Engineering Formation. Some countries, notably France and Greece, do not accept Bologna and the UK, as ever, remains ambivalent. Even in countries which are much more compliant, such as Germany, there are differences of opinion. If there is a consensus, it is that the Construction Sector needs a variety of educational preparation to cover its varying needs and that Bachelor and Masters level qualifications still have a place. There will always be the need for technician Engineers, but that in the future, professional Engineer will need to have at least a Masters (Bologna Level 2) qualification. One interesting idea to emerge from discussion is that the first cycle qualification might come to be seen as a pause, to allow students to break off for a while before deciding whether to go back for a second cycle qualification. This would fit well with the increasing importance placed on lifelong learning.

9.2 The PhD Qualification

What role does the PhD have in the education process for Industry?

There is a view, quite widely held, that the PhD, while inherently valuable, is not necessary for work in the Construction Sector. Some see the qualification as a high level technical specialisation which can have an important role, but many see it essentially as the way in which academics are trained. However, others see it as a way of developing the really innovative and critical thinkers who will be essential to the Industry as it faces the challenges of the 21st Century. It is also recognised in some quarters that the PhD is changing. Increasingly, PhD studies go beyond the study of a particular technical problem to include generic training which will assist students in later industrial careers, and in some cases, such as the EngD Programme in the UK, students spent much of their time in Industry, working on industrial problems, while being registered for a higher degree.

Again, there was no clear consensus on this matter, beyond recognition of the value of a PhD for its own sake, and an appreciation of the high level of critical analytical and creative thinking it can produce. However, there was agreement that the PhD should be allowed to flourish and not become over-regulated by educational bureaucrats.

9.3 External Teachers

Increasingly, external (industrial) staff are used to in providing industrial contributions to teaching. As QA pressures increase, is there a possibility that QA agencies might wish to vet external, non-pedagogically trained contributors to course design and delivery? Might this become a problem?

This question was posed by UK delegates, some of whom are wary of the extent to which their national QAA procedures are becoming over-elaborate, overly-bureaucratic and generally unhelpful. Although this external teaching input is much to be welcomed as a means of linking theory with practice and making courses more relevant to the needs of Industry, there is a potential problem when it comes to quality assurance. As this phenomenon becomes increasingly prominent, it may prove necessary to do more to bring external teachers into the quality process. This may mean an increased need to give guidance and direction to external staff about the educational, as opposed to technical, contribution which they make. During a brief debate, it was recognised that this might be a problem; indeed, this had certainly proved to be the case in one academic Institution. However it had been dealt with successfully and on the whole, members did not consider that this was likely to prove to be a major issue.

9.4 Quality of Graduates

Is there sufficient confidence in the quality of the graduates we produce, and their ability to adapt to professional life? Are we sure that the Industry is sufficiently confident in its own professional standards, which may be coming under pressure because of the current economic climate?

There was little time in the final session to debate this topic. However, it has to be said that some national reports did express concern about it, perhaps not surprisingly, given the large increases in the proportion of young people now going to Universities compared to 20 years ago. This report is not in a position to say whether this is a valid concern or simply one generation lamenting that things are not as good as when they were at University.

9.5 Student Preferences and Choices

One recurring problem in terms of skills shortages is the apparent unwillingness of potential students in many countries to choose technical subjects. This raises again the issue of the attractiveness of the Profession, both in the way the education is delivered and in the career and life opportunities result from such choices. What can we do about this?

Again, there was no time to debate this question. However, it is interesting to note that it is a concern which was raised in the deliberations of Working Groups C and F, and continues to be of concern to Working Group H. /Clearly, some things do not change much.

10. SOME RECOMMENDATIONS

On the basis of what has been set out in this report, a number of recommendations can be made, and these are listed below.

- The Common Platform. EUCEET cannot lead on the development of a Common Platform, though it does have an interest in seeing something develop and in playing a role in its formation
- Quality Badge. Neither EUCEET nor the EUCEET Association is a position to take a lead on the development of a quality badge for Civil Engineering Education across Europe, along the lines of the EURACE award in Chemistry. However, individual members are able to play a role in such a development, as technical and educational experts, acting in an individual capacity.
- Industrial Workshops. EUCEET supports the continuing dialogue between Academe and Industry via a series of Workshops on topics of mutual interest, but believes that these are best organised via existing networks and contacts, since these are best-placed to respond to local, regional and national concerns. EUCEET can play a role as an overseer and disseminator.
- Synergies with Industry and the Profession. This report has compiled interesting and useful information about the value Universities place on their current links with Industry and provided some examples of innovative ways of working with Industry, which are commended to the membership. :

11. CONCLUSIONS

In general, there are very good synergies between Industry and Academe within the domain of civil engineering education and training. Contacts are very well established, have operated for many years and continue to develop. Industry is generally very keen to be involved in the work of the University sector and their involvement is welcomed by students and university staff. The contributions of the two sectors have to be complementary. Universities aim to produce graduates who are well-grounded in the fundamentals and who can think for themselves and solve problems. They aim to produce people with a sound education but an engineering 'state of mind'. Companies bring those professional aspects to the table which it would not be reasonable to expect from university education. Engineers have to be problem solvers and this ability derives from practical experience as much as from a sound engineering education. This can only come from on-the-job training which young engineers can only gain from working in the real world. It is vitally important that these complementary, but distinct aspects of the formation of an Engineer are understood.

To summarise, Universities and Companies need to work together to produce the Engineers of the future and in the main they do this well. Universities should continue focus on the fundamentals, while helping their students to develop skill and at the same time inculcating the engineering ‘state of mind’. Industry should then take the well-formed but essentially raw and inexperienced graduates and mould them to company needs by a programme of training and supervision which will allow them to develop into a real Engineers.

12. APPENDIX 1: LIST OF PARTICIPANTS

The following members have taken part in discussions and correspondence which have contributed to this report.

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13. APPENDIX 2: NATIONAL ‘STATE OF THE ART’ REPORTS

13.1 National Report for the Czech Republic

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13.1.1 Skills Shortages

[1] June 2008

Shortage of workers is threat for global civil engineering.

Shortage of workers threatens the Czech and global civil engineering as well, limits its growth and increases its expenses. Builders miss mostly civil engineering and project managers, craftsmen, specialists and contractual managers. In the Czech Republic and in the world the companies solve the problem mainly by acquiring the workers from abroad. This follows from world-study of consulting company KPMG. Positively the greatest shortage in global civil engineering is in civil engineering and project managers, claimed in about 74 % of addressed companies. In 34% of addressed companies is

shortage of craftsmen, specialists and contractual managers while 30% has shortage of civil engineers. Czech President of Society of contractors in civil engineering told earlier, that on domestic market is shortage of approx. 5000 people.

[2] February 2009

In accordance with inquiry made in January and February 2009 on internet Portal Spravnykrok.cz among small and medium-sized civil engineering companies is the main shortage in the area of civil engineering in particular in civil engineering electricians, where the excess demand/supply is more than quadruplicate. Double demand is for simple civil engineering workers, joiners/carpenters and foremen. Civil engineering companies, on the other side, currently do not demand more qualified employees like engineers and site managers. In January the number of applicants in these categories was twofold. In January in accordance with absolute numbers of the Portal mainly foremen and simple civil engineering workers were looking for jobs and, and the main demand was for civil engineering electricians, simple civil engineering workers and foremen.

[3] April 2009

From year to year, the desperate call from corporate sphere sounds: we have shortage of engineers. Branches, on which the Czech Republic was proud at one time, weaken from lack of interest of young people to study engineering fields of study. In accordance with Institute for information in education, the Czech Universities enrolled this year 17.000 more students than two year years ago. However, in technical sciences the number increased only for 2.400 students. This is in spite of the fact that the technical universities tried to attract as much applicants as possible through various scholarships or sponsorships from companies. However, without any success.

13.1.2 Quality and Standards

[4] July 2008

Shortage of time to elaborate high-quality design documentation, limited financial means, poor choice of contractor of civil engineering works and supervision (in many cases the supervision is made by the contractor himself) are the main roots of low-quality structure execution. If the risk factors are cumulated, the malfunctions may be forecasted with the greatest probability. Therefore, the new concept of quality management and quality assurance is necessary, because the current management is often insufficient. It is inevitable to project the revolutionary economical changes into system of education, namely through open credit courses, possibly in cycles of CPE (continual professional education), and professional seminars. Recently, for example, in German universities have arisen departments focused on new models of company and site management and civil engineering technologies. In the Czech Republic little attention is devoted to such questions in the contemporary curricula.

13.1.3 The Role of Government

[5] May 2009

At present we can see that the current graduates, mostly from universities, are different from former ones. They are more independent (usually they were employed during their study), self-confident and courageous in the sense to take a risk. However, what they miss, and it is not their fault, are abilities to assert oneself in real operation and quick adaptability for a work in the company. The roots may be found in several principal fields. The university professors are frequently separated from practice. Either they did not work in real surroundings at all or left it long ago. They know modern theories, new materials and technologies but they can not pass on to the students the experiences from practice. Even the content and extent of the courses does not correspond to demand of practice in the full. The graduate of a university should be prepared for a job in various technological plants. Monothematic education and perfect knowledge of strictly limited discipline only complicate their use in practice. What miss the graduates? They have nearly no preparation for communication with people, managing of work teams, ability to acquire natural authority due to knowledge, they have little knowledge about law, practical economy from the view of pricing and financing of construction and little knowledge about criminally legal consequences of some negligence acts. Another important thing is to speak about bachelors. Accordingly to law, they are university educated people. However, their use in practice is very limited which is clear from little contractor's interest to offer them a job.

[6] April 2009

The Czech Universities miss 1.500 millions CZK, redundancy is threatening. Government owns to the Czech Universities 1.500 millions CZK for their educational activities. In case, the Government does not succeed to settle the debt, rectors will have to start economize. For example, they will fire employees or lower expenses for technical operations. It means to lag behind the world in technical equipment, told Rector of CTU in Prague. The proposal of Ministry of Finance for this year was initially intended with deficit of 2.500 millions CZK.

13.1.4 Impact of the Current Recession

[7] February, 2009

Today the Czech Statistical Office published last year results which looks in the flooding of bad numbers, for which the economy starts to be used in the last period, as pleasant surprise. In spite of the fact that in 2008 there were less civil engineering contracts, their value was 17.4% higher in comparison to 2007, altogether more than 309.000 millions CZK. However, analysts raise a finger with warning, because the economic crises does not avoid not construction sector and the accomplished projects are rapidly decreased. Results of civil engineering sector are good especially due to public contracts. Their amount was interannually higher nearly for one half and amounted for 182.000 millions CZK. On the other side, in accordance with bank analysts, the contracts for construction of apartments and commercial buildings direct sharply down. After years of massive construction of apartments and commercial objects a recession and slump is coming.

Demonstration of crisis in civil engineering sector may be illustrated by results from last quarter. There are 27% less contracts for new flats. Even worse is situation in contracts for non-dwelling industrial contracts, where the fall is 44.7%. The slump is mainly in more demanding structures of traffic infrastructure. In comparison with the last year's contracts the average value of the new ones has been increased for more than one third, to 4.3 millions CZK. Especially the public contracts are noticeably more expensive. In the last quarter their average value was 9.3 millions in comparison to 2.5 millions in private sector.

[8] March 2009

The economic crisis in the Czech Republic decreases the number of contracts, especially from private sector. This was confirmed from an inquiry among the leading civil engineering companies. It has to be said that only 2 years ago the contractors had to refuse the new contracts because they did not kept them up due to construction boom. In the competition some of the companies were said to underbid the prices, to be under the real spending. Such approach may result in relatively short period to not paying to the first contractors with following bankruptcy of these companies. Contractors are also afraid of postponing or even stopping of some contracts. Economic crisis may supposedly lead some companies working mostly for private sector to public contracts. At the same time to accept smaller commissions, which were formerly not attractive. The last year global civil engineering works in the Czech Republic according to Statistical office increased for 0.6%, what means the lowest increase from year 1999.

13.1.5 Other Points to Note

[9] August 2008

Opening market of European Union to authorized persons (chartered engineers) is without doubt the basic problem to be solved by the Czech Chamber of Civil Engineers. This belongs to the primary activities of the Chamber. One of the big debts of the Chamber to its members is a fact, that authorized person is not accepted in e.g. German speaking countries and on the other side the market of the Czech Republic is relatively open to foreign persons. The Chamber itself can not solve the whole problem of closed or open job market of EU, but at least could prepare for its member meaningful information on current situation. The colleagues from abroad should be involved, especially from Germany, together with governmental deputies to discuss this situation, because it is non-correct to all our authorized persons.

13.1.6 References

The above was based on the following articles and commentaries:

1. iHNed.cz (electronic newspaper), 16. 4. 2009
2. Konstrukce (Structures), No.2, 2009

3. CTK (Czech News Agency), 26.06.2008
4. Stavebnictvi (Civil Engineering), No. 7, 2008
5. Stavebnictvi (Civil Engineering), webpage, May 2009
6. CTK (Czech News Agency), 16.4.2009
7. CT24 (Czech Television), 26 February, 2009
8. iHNed.cz (electronic newspaper), 16. 3. 2009
9. Stav

13.2 National Report for Denmark

Contact: Jacob Steen Moller jsm@byg.dtu.dk

13.2.1 Manpower Supply for Industry

During the last 25 years it has been a general perception in industry, among politicians and the public that there is a unfilled need for civil and building engineers, and indeed the unemployment rate is very low even in these difficult times (2009). In particular in the field of road and rail construction there is an unfilled gap, which has been identified with deteriorated research and innovation in this field in universities. However some studies (by the contractors' organisation, Dansk Byggeri) suggest that the number of academically educated civil engineers will not be to low in the coming 10 years. Especially the public sector is actively seeking to attract engineers again after a period of more focus on economy and general competences among public managers.

13.2.2 Quality and Competences of Graduate Output for Industry

During 2004 the academic level of the university educated engineers was dramatically (and to some extend unjustified) criticised by the Association of Consulting Engineers. Partly as a response to this criticism the Technical University of Denmark established a series of networking events and workshops (aftagerseminarer) where employers were invited to discuss and influence the curriculum and pedagogical element elements of the education. As a result of this activity the educations at DTU has been revised and the Bologna 3+2+3 system introduced. For the bachelor of engineering programme at DTU the CDIO system has been introduced, see: <http://www.cdio.org/> . As a result of these and other initiatives the overall repute of the young newly educated engineers has risen among employers and in the public.

13.2.3 Skills Shortages

The following areas have been highlighted as areas within civil and building engineering where there is a strategic skills shortage:

- Civil works and infrastructure planning
- Climate adaptation, planning an management
- Building energy and installations

The industry has responded to the skills shortage by sponsoring courses and professorships in rail construction and (from 2009) hydraulic engineering.

13.2.4 Difficulty of Finding and Retaining Suitably Qualified Personnel

In the boom up till 2008, Industry was headhunting students during their thesis work and even PhD students were head hunted out of their projects. This has slowed down since 2009.

Industry complained that output from universities was too small. However the output is mainly governed by the number of interested students, since admission has in essence been free except at DTU where admission is restricted.

It ma be noted that the number of students applying for entry at DTU has risen from 1600 in 2002 to nearly 3000 in year 2009. The rise in applications has been particularly high for civil and architectural engineering where admission has been restricted by capacity and regulated through admission grades since 2006. In 2009 the number of applications was twice the number of admission places.

An interesting finding has been that some firms, both consulting and contractors, during the last 5 years have begun using industrial PhD grants as a recruitment mechanism. Firstly they attract the best

students and produce targeted knowledge for their own company, secondly they raise the esteem of their company among other students and thirdly they participate in raising the esteem of the entire business in society.

13.2.5 Future Training Needs

The training needs for already educated engineers are generally covered by short courses provided by the employers and private knowledge companies. Formal competence giving education (Master programmes for professionals) is offered by the universities in the following fields:

- Fire (functional based design)
- Construction Planning and Management
- General Business Management

It is envisaged that training in the future will include master programmes in:

- Energy efficient building
- Facilities Management

13.2.6 Perceived/Required Changes and Developments in Engineering Education

Since 2001 a number of changes have been implemented:

- 2001: The Architectural Engineering programme was opened
- 2002: Arctic Technology programme (starting with 3 semesters in Greenland) was opened
- 2005: The Bologna was adopted (3+2+3)
- 2007: CDIO was adopted for BEng programmes
- 2008: A number of synthesis/design courses were included in the academic CE programme.

National Accreditation of all BEng, BSc, and MSc programmes was initiated in 2007/8. The process is putting a strain on resources at universities. The present author is seriously in doubt if the accreditation process will increase educational quality.

The number of female students is now 50% in Architectural Engineering and above 30% in Civil Engineering at DTU. The present author advocates that we maintain a gender balance in this range, since experience in other education programmes (medical and veterinary science) has shown that male students flee programmes with an overweight of female students.

13.2.7 Impact of the Current Recession

The current crisis has increased the number of student seeking admission to civil engineering even more.

The industry particularly contractors building homes have laid off engineers, however it seems that the slow down to some extent is balanced by an increase in need for engineers to realise the large infrastructure projects currently under way in Denmark: The Fehmarn Belt Link between Denmark (Copenhagen) and Germany (Hamburg), Copenhagen Metro, A number of planned motor ways, A number of new/renovated rail lines, off shore wind parks, large investments in regional hospitals.

13.2.8 References

The following reports (mostly in Danish) may be consulted for further reading.

1. Koordinations- og Initiativgruppen for viden i byggeriet, Erhvervs og byggestyrelsen: *Byggeerhvervets forskningskatalog*. (In press).
2. Akademiet for de Tekniske Videnskaber: *Fremtidens byggeerhverv i et globaliseringsperspektiv*, pp. 33-41, ISBN 978-87-7836-047-2. Denmark 2009.
3. DTU og Vejdirektoratet: *Fremtidens veje? Bedre veje gennem forskning og uddannelse*. Januar 2008.
4. Møller, J.S. and M. Geiker: *Bygningsingeniøruddannelsen på DTU – med speciel vægt på beton som byggemateriale*. Presented at Dansk Betondag (in Danish) 15 Sep. 2005.
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13.3 National Report for Finland

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This data set is based mainly on the “National Report on Workforce Education and Skills at the Construction and Real Estate Sectors 2008” (later referred as Report), compiled by the Association and Helsinki University of Technology, including some more recent statistical data.

13.3.1 Manpower Supply for Industry

The total number of MSc Civil Engineers in the workforce is estimated to be 5800 persons, while the whole population of Finland is approximately 5.2 Million inhabitants. The age structure of the employed is weighted to the age groups of 36 years and older, especially to those close to retirement (51-65). The recession of the early 1990s can be seen clearly as the small age group of 31-35 years. The intakes for the universities were cut roughly by 40 per cent in 1993-94, and a majority of graduates of the period 1992-1996 were employed to other sectors. Only few have returned.

The number of retiring civil engineers is estimated to be about 170 persons per year for the period 2008-2017. (Image 1)

Since 2001 the university intakes have been relatively stable, about 220-250 persons per year in two separate University units (Helsinki and Tampere). Civil engineering has also gained popularity year after year, as the number of primary applicants has grown to about 600 per year. However, the university dropout rates are still high, about 30 %. Thus the number of graduates can be estimated to be 150-170 persons per year at least till year 2015. Even though the young persons do not directly replace the experienced, the total number of graduates can be seen to be roughly on the right level. (Image 2)

Currently the number of graduates is first and foremost sensitive to keeping the university intakes stable and lowering the dropout rate. From the industry point of view, structurally a major factor is the division of work between M.Sc.:s and B.Sc.:s – the latter graduating from several Polytechnics.

The Report included a questionnaire on the employers’ motivations to recruit in the close future or not. Major factor was the generic economic outlook. Remarkable factors were also staff retirement, company market share and demand for new skills. The results can be interpreted so that a grim generic outlook prevents recruiting, whatever the retirement rate.

13.3.2 Graduate Quality, Competences and Skills Shortages

The Report included also a questionnaire on the expected competences of young recruits. In addition to the 148 employers who answered, an interview round of 11 HR Directors and CEOs of leading companies was done.

Out of the two largest fields of skills for the young recruits, retrofitting was seen as 20 % more important than greenfield construction. This opinion preceded the fact that in 2009, for the first time in Finland the retrofitting industry volume grew larger than greenfield production.

When asked about the average skills of young recruits on a scale 0-5 (5 being excellent), the employers gave them the grade 3,7 (good plus, that is). This was the average for all recruits independent on the level of their education. University-level civil engineers scored 4,2. Open question on missing competences produced a longish wish list, but the small number of those answering does not provide statistical evidence.

The list on specific knowledge that graduates are typically missing included e.g.

- Energy efficiency and moisture control
- Eurocodes
- Automation
- Building Information Modeling BIM
- Bridge design, especially retrofitting
- Geomechanics and rock construction
- Railway design and construction
- Structural design.

Out of more general skills, both current employees and future recruits were considered to need further training on

- Project management
- Procurement, contracts and legislation
- Leadership skills
- Development skills
- Presentation skills
- Finance and economics
- Customer skills.

Both of these lists apply for all young recruits, but they are evidently true also for the subgroup of university graduates. They are also at least partially misleading, as in his or her early career a young employee typically needs only with a fraction of the listed skills and knowledge at a time. More will come with experience, supplementary training and more demanding projects. The employers' feeling that something is missing comes most likely from a difficulty in recruiting and/or difficulty in moving employees to new tasks of which they do not have previous experience of.

13.3.3 Required Developments in Engineering Education

The Report concluded several points that are directly applicable to civil engineering education at universities. According to them, the studies should (more than now)

- be based on projects
- introduce typical project tools, starting from team work
- be closely knit to business by using visiting lecturers, especially in applied courses
- make sure that the visitors' input is applied also to the university's body of knowledge
- co-operate with other local educational institutions, both vocational and polytechnics
- consciously differentiate the university students' skills profiles from other institutions.

To ensure the future success of the construction and real estate sector, it was considered necessary to ensure enough resources for the university education in these fields. By now the resources even for basic teaching tasks were seen as worryingly low. The universities were also expected to differentiate themselves from each other by directing teaching and research towards industry's and research and other educational institutions' local focus areas.

In addition to the two major viewpoints of today's civil engineering education – one for design and the other for construction – it was considered necessary to introduce a third approach. It should concentrate on customer needs and service businesses over the entire life cycle of the built environment.

The Bachelor degree caused some concern among employers. The degree was introduced to the Finnish higher education as a result of the Bologna process, having previously been at use only in the Polytechnics. The employers expected that close to no university student would skip the Masters part of their studies, as the first part is seen as theoretical and as one that does not provide real tools for working life. Same can be put more straightforward: Bachelors from Polytechnics are considered as readily productive, Bachelors from universities as raw material that cannot be used as such.

It was noted that not even a graduate with a Masters degree is productive from day one. This was not considered as a handicap, if the resulting graduate has the versatility, ability and will to learn and develop. Strong background on natural and applied sciences is necessary, but the true value of a university graduate is realized only when the technical knowledge is combined with administratively, financially and socially demanding projects and situations. To develop students towards this, the university should encourage students to interdisciplinary major-minor combinations. This should be done also by attracting students from other fields to choose their minor subject from construction and real estate.

13.3.4 Future Training Needs

All directors interviewed for the Report admitted that no clear set of skills and data will be enough for any graduate for his or her entire working life. The needs are changing at rapid pace at all levels of business, society and the environment. Thus it will be necessary to learn, apply and also forget new and old truths throughout anybody's career. Training for this cannot be only the responsibility of the universities.

For updating the knowledge and skills of their personnel, all of the big companies had established programs for knowledge dissemination and training. At its simplest this meant short in-house info events once a week on acute matters. At the other end are the outsourced training packages comparable to 20-40 % of an MBA. Part of the outsourcing is bought from the universities, notably from their centers for extension studies.

13.3.5 Impact of the Current Recession

Current downturn has cut construction site starts by 30-60 % (depending on the construction subsector) from previous year. The percentages are somewhat misleading, as 2008 saw the end of boom that has been accumulating since the last recession. The government has also been rapidly responsive to the demands of the industry and large recovery measures have been activated to avoid large-scale collapse. Out of the total work force of 190.000 employees, about 40.000-60.000 have been estimated to be unemployed still by the end of 2009. The structural base load is 15.000 unemployed even at the best of times.

For civil engineers, the outlook is still far from catastrophic. The total unemployment rate is about 2 per cent, which can be considered almost as full employment. The relative number of unemployed or laid off individuals has anyhow grown remarkably during 2009, being 230 persons by the end of July. As also construction sites are becoming completed by the end of year and large part of design work for close future is already done, the situation is still likely to get worse. It might take years for this development to change direction back to positive.

13.3.6 Research Work in Collaboration with Industry

At Helsinki University of Technology, 42 percent of the total funding comes from outside the University. Of this, roughly one half originates at the industry directly. Another half comes through the Finnish Funding Agency for Technology and Innovation, and the Academy of Finland. The funding is compiled from various research projects, which are supporting the final PhD- and MSc-theses. The topics for these projects originate often at the problems met in the industry. To some extent, the industry is supporting the basic research in addition.

13.4 National Report for Germany

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13.4.1 The Bachelor Gets Going in Civil Engineering

Following the introduction of the Bologna Process a complex discussion on structural changes in the German system of university education is currently being held in the field of synergies between the academic and professional worlds in Germany. This new situation is controversially discussed especially at the universities, but also in the building industry. In 2010 all the Diploma Study programs should be replaced by the Bachelor and Master programs. But according to an actual survey with 5,000 personnel experts showed considerable reservation concerning the qualification of the latest generation of students in June 2008. Especially aspirants with a Bachelor degree might have problems getting a job. 61,4 percent of the surveyed personnel experts prefer the diploma as the better alternative.

Also the students are in two minds about the Bachelor system – that's the result of the tenth "Studierendensurveys" (Studentssurveys) published by the Ministry of Education. Only 12 percent of the surveyed students assume good job chances having a Bachelor degree. In 2001 this number was about 25 percent. 44 percent advance the view, that the Bachelor system limits the individual study arrangements. The exact opposite was the main aim of the Bologna reforms. 52 percent do expect that the Bachelor is developing to a graduate of second class. Especially students of the engineering sciences threat the Bachelor system with reserve. Meanwhile the German Hochschullehrerverband (Association of University Professors) is speaking about a red alert concerning the Bologna reforms. A few employers are trying to reraise these fears. Therefore 38 companies gave new impulses to the initiative "Bachelor Welcome" during the 30th June 2008 in Berlin. In order to understand better, why the discussion is so controversial it is worth to have a look briefly at the traditional engineering education and at the current situation in the construction industry in Germany.

There are in principle two systems of German engineering education, the Fachhochschule (FH) and the Technische Hochschule or Technische Universität (TH/TU). According to the constitution of the Federal Republic of Germany, education is the responsibility of the federal states. The federation only controls the general principles of the higher education system which are set in the Federal Higher Education Framework Act.

"The higher education system promotes and develops science and art through research, education and studies. The institutes of higher education prepare (students) for professional activities which require the application of scientific know-how and methods... . The different types of schools contribute to this aim according to their specific tasks. Universities link education and research in order to provide a primarily scientific education. ... Fachhochschulen offer application-oriented education which enables students to make use of scientific methods in professional practice. Fachhochschulen may pursue applied research and development projects which support their educational tasks in so far as they are financed by third party funding. (Article 2)"

German engineering education normally does not have a tutorial system or fixed learning groups. Students are expected to initiate their own study teams. It is a system in which the student acts primarily as an autodidact drawing educational benefits from the system according to his or her own estimation and decision with a certain amount of orientation naturally being given by assistant staff and fellow students. However, the system does not actively “form” the student as is the aim of the French system of formation. Students become formed by succeeding in the system, open and liberal as it is.

While attendance of lectures and tutorials is in general not compulsory, examination prerequisites in the form of calculations, design work and lab reports are controlled thoroughly and the examination themselves are subject to strict organization and high standards. Although there is now a tendency to prescribe a more strict schedule in particular for the basic study phase, German engineering students are not usually obliged to sit an exam immediately after the semester in which they attended the particular course.

The typical engineering professor at a university works at a considerable distance from the students. His or her function is to run a unit (Lehrstuhl, Institut) which is engaged at once in research and in education. The professor is responsible for the management and maintenance of this unit, the development of research projects and for raising sufficient funding. During the lecture period (there are two per academic year, each of 15 weeks) he or she gives 8 lecture hours (each of 45 minutes) per week and is active in academic coordination and self-administration. In the lecture-free period he or she has to organize and supervise the examinations. It is mainly the advanced and postgraduate students who pursue project work in a research unit or are employed in a research team who have the opportunity to learn through personal interaction with the engineering professor.

The situation is, to some extent, different at the Fachhochschule: the FH-professor gives 18 lecture hours per week, the FH-lecture period comprises 9 weeks more than that at the university and the schools and their sub-units are smaller. Research activities play a minor role. The professor at the Fachhochschule therefore has more contact with his or her students. This situation is, however, affected by a surplus of students and a shortage of teaching staff.

It is primarily the level of mathematical instruction and the extent to which subjects such as physics and mechanics are based upon advanced mathematical methods which make the actual difference between the education provided at the Fachhochschule and the Technische Universität. Both institutions stress their practice-oriented approach, their point of reference obviously differs: the FH refers to the professional practice of engineers, the TH/TU to the practice of advanced R & D. The position of both institutions in relation to each other is a permanent subject of reflection and discussion in Germany.

The Fachhochschulen have far fewer assistant scientific staff as well as less equipment, and funding and therefore do not have the capacity to pursue basic research and complex R & D projects. The education provided by the FH is thus not designed to promote a particular research ability among the engineering students.

Due to the uncertainties of the economic development in Germany, and in Europe as a whole, it is not possible to forecast the demand for engineers more precisely. The interest of school-leavers in engineering studies obviously reflects the movements in the labour market. Placement problems usually reduce the number of new students, which leads to a shortage of engineers after one cycle of studies.

The number of newcomers in the civil engineering in Germany has during the years vigorously declined. In 2001 the number of newcomers has stabilized, but on a very low level! The information is for the whole building industry alerting. Since 1997/1998 the number of newcomers in all kinds of universities declined at 40 %. It is especially dramatic in technical universities, where future managers are educated. This group of beginners has declined at almost 60 % in whole Germany in the considered period of time.

The major reason for the loss of applicants for a place at the universities are mostly negative headlines about the decline of building activity or the spectacular failures, but not the number of unemployed engineers. It is true, that the building branch has to put up with the reduction of investments. But that

fact could not really surprise, because the reintegration of East Germany caused an unusual building boom, which had to fade away inevitably. The negative development, which was purely a German problem – in Europa and the whole world the figures are quite different – is in the meantime to the greatest possible extent abated.

The fact remains, that each 12th employee in Germany is directly or indirectly engaged in the building branch. The building industry remains a key national industry. With a 14 % share in the gross domestic product it is one of the most important branches of industry in Germany. However the building branch is at structural change, which demands a unanimous notion of all engineering experts and especially long-termed highly qualified personnel, it means civil engineers, who graduate from universities.

13.4.2 Quality and Quantity should be Proportional

From point of view of the Civil Engineer the question of the quality of education needs to be answered as urgently as the question of quantity of the young academics. The latest release of statistics concerning the number of civil engineering students from the Hauptverband der Deutschen Bauindustrie (Association of German construction industry) shows more Bachelor and Master students than diploma students for the first time. In the summer term 2007 and in the winter term 2007/2008 4676 freshman students enrolled to the Bachelor systems (3150 at Fachhochschulen, 1526 at universities) but only 1326 matriculated to the diploma system. That means 78 percent of freshman students prefers the Bachelor system. The total number of the first term-students in civil engineering decreased to 6.002, which means 0.8 percent less when compared to the lowest level of 2006.

13.5 National Report for Greece

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In this brief report on the theme of developing synergies between the academic and professional worlds in Greece, with specific reference to civil engineering, an attempt is being made to address all critical factors that affect this crucial issue for the country's economic development. To this end an integrated approach is employed in order to identify the impacts of various agents from both the educational and labour market systems, as well as to highlight the most significant relationships between them. Within this framework, the rest of the report is structured in five distinct sections, plus a Bibliography one. The five main sections deal with: a) the demand and supply status in formal and continuing education of civil engineers, b) a review of past and present employment practices, including recent trends in career decisions of young professionals, c) the particularities and especially the mismatches between higher education and the labour market, d) the changes and developments needed in restructuring university curricula, and e) a preliminary examination of the related impacts on the profession of the current worldwide economic crisis.

The views and information presented in this report are mainly based on findings and relevant discussions obtained from various texts, such as newspaper, magazine and journal articles, institutional reports and meetings summaries, the most important of which are cited in the "Bibliography" section. A significant part of this written evidence draws conclusions from surveys that have been recently conducted using samples from different, yet related populations, among which engineering professionals, graduates and prospective students consist the dominant groups of respondents.

13.5.1 Formal Higher Education and Continuing Professional Development

Entrance to higher education in Greece is attainable for students who have attended lyceums, i.e. those who have already received 12 years of formal education. This continuation of studies requires the successful participation in general nation-wide examinations, a system based entirely and exclusively on the high school curriculum. Students declare their preferences for institutions and further on for specific schools/departments after an initial selection of the major fields of study, each of which comprises a specified set of institutions. civil engineering studies are offered by five universities (with courses running for ten semesters) and a few technological institutions (with courses running for seven to eight semesters).

Under the described system of examinations, access to higher education in Greece is highly competitive, at least for some disciplines (e.g. medicine, law, engineering etc.), of which the number of available university places is not sufficient to meet the extremely high demand. This condition is driven by the conception of Greek students and their parents that university education offers increased

opportunities for a good job, and thus for greater economic benefits, a steady career development and, last but not least, an upward social mobility. This is why, of those who are not successful in entering a national university, a large number of them opts for enrollment in university studies abroad, instead of continuing their studies in technological or vocational training institutions at home.

Civil engineering stands among the first preferences of candidate students in the general group of major fields that comprises all branches of engineering, the natural sciences, information and computer technologies and so forth. During recent years, more than 60% of successful entrants in the country's civil engineering departments have declared this discipline as their first-choice one, while more than 90% of them have included it in their 1-3 most preferable disciplines. Given the relatively high number of places offered in all civil engineering departments, the annual total output of domestic graduates fluctuates around 1,000, to who another 200-250 are added from those immigrating after completion of similar studies abroad. Before entering the labour market, about 40% of all these graduates continue for postgraduate studies, either at home (55%) or abroad (45%).

Although quite respected and fairly-high demanded by young professionals, continuing professional development is not widespread in Greece. Unfortunately, universities have not yet been involved in this kind of activities, leaving thus space mainly to the Technical Chamber of Greece, which represents all registered professional engineers in the country and acts as an advisory body to the government. In fact the Technical Chamber operates quite successfully a relevant service, by offering short courses and seminars on a wide range of subjects to its members.

13.5.2 Employment Status and Career Decisions

Civil engineers used to be among the most active and prosperous professionals in the country, first of all during the three decades following the second world war, when they undertook a major role in the nation's big reconstruction enterprise. Most of the profession's long-lasting nationwide popularity owes a lot to that particular "golden age" of the construction industry. In the following period (i.e. from late 1970's to late 1980's) the construction rate of public infrastructure declined. Yet, practicing civil engineers continued to be quite busy working either as self-employed individuals or engaged in numerous small-to-medium size engineering firms, mainly supported by private sector funds invested in housing, real estate enterprises and other projects (e.g. for the development of many tourist regions).

The principal characteristic of the period up to the 1980's is that the number of civil engineers working in Greece was at maximum only half of the totally employed ones during the 1990's and almost a quarter of today's workforce. Thus, the apparent prosperity of those professionals was due also to their high personal share in the construction business. This share became much lower during the next years, as a result of a rapidly increasing rate in the number of young civil engineers entering the profession, the main driving forces for this being: (a) the quite attractive, still fictitious, picture of an occupation that seemed to secure economic benefits, and (b) the beginning of the massification in higher education, which quite shortly doubled the output of graduating engineers.

The current workforce of civil engineers in Greece amounts about 24,000 university graduates, a significant percentage in regard to the country's population and substantially above the EU average. Overall unemployment averages 2-3%, but a steep upward trend at almost two-digit figures holds exclusively for the new generation of civil engineers. In addition, there is notable evidence that, mainly in the private sector, unemployment rates of engineers may vary depending on the institutions from which they graduated. Still, these figures are relatively low when compared to those concerning lots of university-degree holders from other disciplines. Misemployment rests also at non-alarming levels, far below the national average for educated professionals.

What, indeed has changed today, as compared to the recent past, is the type of employment. A second period of blooming of the construction industry, that initiated in mid 1990's and lasted up to 2004, when the Olympic Games took place in Athens, was marked by high investments, particularly by European Community Frameworks' and national funds, in the construction of several major public works, some of which reshaped in a very positive way the transport infrastructure and services, mainly in the area of the country's capital. The already expanding at that time big consulting and construction firms – to the detriment of many small-to-medium size ones, of which the net creation of new firms started to decrease constantly – profited more, by not only undertaking huge projects at home but also by extending their business in the neighboring Balkan countries. These big enterprises moved young engineers away from traditional self-employment to non-permanent job engagements in the big firms. Unfortunately, this very productive period did not last for long. To the worse, it was almost immediately followed by a rising recession that lasted up to our days when the global financial crisis multiplied the existing negative impacts.

As a consequence, in today's real world career planning of new civil engineers is mostly affected by sound insecurities as to the future prospects of a profession that does not seem any more to be a lucrative one. Thus, in relation with the first professional engagement a rather typical decision path is being followed. Data from recent surveys show that the majority of fresh graduates opt for a permanent employment in the public sector or, if this is not possible, for a part-time contracted one to it. As the number of relevant available places is not abundant, from those who do not succeed some try self-employment risking thus serious intermittent periods of professional inactivity, while the rest settle for various types of jobs offered by an unstable private sector, at the cost of low remuneration, sometimes even less than of the already low-paid public sector.

13.5.3 Mismatches between Higher Education and the Labour Market

Although recent Civil Engineering graduates are in general not dissatisfied in making their way through the labour market, a more careful insight into their professional status and rewards provides some additional points for a further discussion. The present discussion is confined to existing mismatches between the education, which has already received any individual entrant to the labour market, and the qualifications associated with the particular occupation, for which he is applying. The most apparent occupational mismatches in relation to Greek university-degree holders, apart from their oversupply mentioned previously, include excessive schooling duration (and, consequently, excessive acquired degrees), a redundant theoretical-academic background and a shortage of skills specifically required by the private sector.

First of all, the phenomenon of overeducation dominates all over Greece. As mentioned before, the number of those who proceed with a further upgrading of their formal qualifications (i.e. for postgraduate degrees) is significant. Such a trend is justifiable only in part, and more specifically by the tough competition among an increasing population of graduates who apply for employment in the, more or less decreasing in size, public sector. As a result, the hiring policies of the public sector favor the recruitment of university graduates. Still, it can be easily substantiated that the majority of public servants are overqualified for the service they provide, or, in other words, that all these workers' educational capacities and skills are underutilised. Monetary rewards are also low when associated with education, especially at the higher levels. On the other hand, the private sector in average does not appreciate much extra qualifications, like master's or higher degrees, with the exception of some specialisations, which, depending on the case, can be considered useful. Normally, an undergraduate degree is considered adequate for the employment of young graduates in small engineering firms, as their leading preference for them is to have enough working experience in order to be immediately productive.

As far as the knowledge and skills acquired during their rather long period of university studies is concerned, young Greek employees of the public sector and, even more, of the private one admit that they substantially oriented towards a solid traditional model of civil engineering education. Such schooling, albeit it provides students with a probably more than adequate theoretical knowledge and sufficient technical skills, it lacks some specific elements that are of high value within various job environments. And, above all, this mono-disciplinary education shapes a classic engineer profile, which is, more or less, out-of-date, considering the complexities and uncertainties of modern techno-economic systems. Of course, discrepancies between contents of studies and employment vary, depending not on the type of occupation alone but on the diversities of academic curricula offered by different institutions. Still, practically all Greek university syllabi are to some degree inadequate, concerning the provision of certain specific knowledge topics and skills, and they therefore need to change, somehow as presented in the following section.

13.5.4 Required Changes and Developments in Education

Education and the professional practice of engineers are linked to economy and the labour market at a degree that depends on both the structure and dynamic development of the economy and the timely adaptation of university curricula. However, this arduous relationship should be as tight as possible at any time. To this aim, civil engineering studies should provide: (a) a sound scientific-theoretical background, (b) a related to the discipline at hand technical knowledge, (c) knowledge and practice on ICT applications, (d) a basic inter-disciplinary background on topics useful in the current professional activities, and (e) the training for the development of specific skills, especially non-technical ones, also dictated by the labour market needs.

Surveys administered to new employees and their employers show that the last three items of the above list need, at varying degrees, a proper enhancement. Most respondents suggest the introduction of new or the improvement of existing courses and training modules in the topics of law, economics and

management. Such a curriculum development could benefit not only the graduates who will choose to be employees but also those who would select self-employment. As already mentioned, the great many self-employed civil engineers in Greece, who used to be quite useful to the country's economy, are lately declining in number, particularly because of the reluctance of younger professionals to initiate such an occupation under the current difficult and unsafe conditions. To a certain degree, the hesitation to establish their own small firms is attributed to the lack of sufficient entrepreneurial capabilities. Therefore, the provision of additional education and training in the three specific topics above would much probably result to more self-confident and self-efficient prospective young entrepreneurs.

Additional suggestions, declared both in surveys and expert meetings, for further educational changes and curriculum development include: (a) an interdisciplinary learning about a wide spectrum of environment and energy issues and (b) general training modules in information and computer technologies plus a selection of specialised computer applications (for all sub-disciplines of civil engineering), which are used by the practicing professional world.

13.5.5 Impact of the Current Recession

It is beyond any reasonable doubt that the current world economic downturn will seriously affect the industry, but, to some degree, the academe as well. Early signs of its harmful impacts relate to numerous Greek enterprises, among which quite many from the construction sector. Not only the public sector has reduced existing and planned funding in infrastructure projects but also the private sector seems quite helpless in risking new investments, as they already massively report declining turnovers. As civil engineering professionals are predominantly involved in traditional construction and building activities, yet much less in RD ones, it is probable that the crisis might generate a positive opportunity for a shift in other new developments and technologies, which, after all, would benefit the country's development.

However, up to the time that the whole system will be reorganised and conformed to the new reality, the difficulties of young engineers in finding the employment of their choice are not likely to improve at all. Apart from this immediate consequence to the current workforce, such an ominous prospect could adversely affect the above described traditional high demand for civil engineering studies, at least from among the most qualified graduates of lyceums.

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Most of the graduates (97%) is employed three and five years after graduation. A quite large percentage (about 70 % from 2000 to 2007) has a permanent position without any difference among men and women. It is worthwhile to remark that for civil and environmental engineers the percentage of permanent positions (year 2007) is only 55%.

Generally, the time required to find the first employment is three months.

It is possible to draw a first conclusion: Italian Engineers easily and quickly find a job which is not well remunerated.

In 2006 the labour market has requested 19000 new engineers (practising engineers, companies, public administration) in front of 24000 new graduates in Engineering. Anyway, since 2006 the number of new positions offered by the Public administration started to decrease: only 436 new positions against 900 new positions in 2005. In 2007 while the request of Engineers was more or less stable (-0.2%), that of Civil Engineers sharply decreased of about 12% because of the Italian crisis of the construction sector.

It is worthwhile to remember that Almalaurea database contains 1.200.000 curricula of new engineers. To have an idea of the impact of the actual economical crisis, it is interesting to remark that in the first bimester of 2009 the request of curricula from the Almalaurea database had a reduction of 23%.

More generally, the Italian labour market consists of small and very small companies. Such a type of companies has tremendous difficulties to support the cost of very qualified engineers and to compete at an international level.

The situation is even worse for civil engineers. It is worthwhile to remember that, as far as the Engineering Services are concerned, different competitors are present in the market. More specifically:

- technical staff of Public Administration or Public Bodies;
- engineering societies
- individual practising engineers
- international operators.

Statistics referred to year 2000 indicated that totally there were 77000 practising engineers, societies with more than 6 employed people were less than 650 whilst 13000 societies had between 2 and 5 employed people. Individual practising engineers had more than 40% of the market whilst the technical staff of PA and Engineering Societies (more than 6 employed people) had about 30% each.

In addition, referring to the same statistics of year 2000, 81% of practising civil engineers had their activity within the residential district, another 14% had their activity within the residential region. Only 5% had activities over the Italian territory and less than 0.8% outside Italy.

Eventually 90% of the job was obtained without participating to any public competition.

As a second conclusion, it is possible to state that the Italian labour market for engineers (especially civil engineers) is not competitive, nonetheless it consists of many individual subjects.

13.6.2 Basic Requirements for Industry

Companies, employing engineers, essentially ask for the following requirements:

- previous experience in the same job or at least in the same type of economic activity (65.5%);
- robust knowledge of computer science (99.4%);
- knowledge of a foreign language at least (73.2%);
- courses organised by the companies for engineer-training.

On the other hand, post-graduate courses of specialization (i.e. masters, doctorates, etc.) are required, on average, only in very few cases (9%).

Table 2 summarizes the basic requirements for different type of Engineers as emerged from statistics elaborated in 2007. In addition to the information reported in table 1, it is worthwhile to point out that the knowledge of "Computer Science" (as users or as experts) is required, for any type of Engineering, in more than 99% of cases.

It is also important to point out that the percentage of Civil Engineers that are employed as manager is lower in comparison to other types of Engineers.

Table 2. Requirements from Companies

Engineering	(1) %	(2) %	(3) %	(4) %
Civil & Environmental	13.2	30.9	62.9	45.0
Electronic and Computer Science	8.3	49.6	67.2	77.3
Industrial	7.3	49.5	65.0	76.0
Others	10.5	42.2	62.2	67.5

- (1) Post-graduate courses
- (2) Training organised by the companies
- (3) Previous experience
- (4) Knowledge of foreign languages

13.6.3 University Outcome

As a general premise it is worthwhile to stress that since 2002 the number of pupils entering University Studies has continuously decreasing from about 75% to 69%. Anyway, the number of students of Engineering Faculties is more or less stable in the last ten years. Yearly, about 35000 new students are enrolled by the Engineering Faculties.

Statistics provide by Almalaurea indicated that graduates in civil and environmental engineering (2008 – first level degree – 2300 answers) graduated after an average period of about 5 years at an average age of 24.5 years. A large percentage of those graduates entered the second (Master) level (85%). A very small percentage of those graduates attended a (post-graduation) practical placement or stage or training course in the Industry (totally 15%). About 44% of those graduates became employed after graduation but only 70% of those employed declared their own graduation useful for their job. The same statistics by Almalaurea (2008 – second level degree -374 answers) indicated that the Master degree in Civil and Environmental Engineering was obtained after an average duration of about 2.5 years at an average age of about 26 years. A quite large percentage of those Master graduates has attended post-graduation courses (9% practical placements in Industries; 11 % doctorate; 17% stages in Industries; 11% others). As already indicated, a very large percentage of graduates is employed few months after graduation and for Master graduates only 5% declared that that their own graduation was not useful for their job.

In conclusion, the student career is slow and does not have too many contacts with the professional world, especially as far as the first level degree is concerned. Student qualification, which in general is quite good, is not recognized and appreciated by the labour market. More specifically, even though a quite large percentage enters doctoral studies, the labour market completely ignores this type of qualification.

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13.7 National Report for Poland

Contact: Wojciech Gilewski W.Gilewski@il.pw.edu.pl

It is typical and natural for Poland that most of the university staff is working in the industry. Why? There are three reasons: money, money and ... money. It means that there are the same actors (and a couple of actresses) playing roles in the theatre of professional world and in the theatre of academic world. It is good and bad together. Good because the academic teachers have a professional experience and can include practical aspects into teaching. Bad because theoretical subjects (mathematics, physics, mechanics, computational methods, etc.) are usually separated from more practical subjects – and the theoretical base of the teaching is increasing.

There are three “legs” of developing synergies between the academic and professional worlds in Poland:

- Committee of Civil Engineering and Hydroengineering of Polish Academy of Sciences,
- Polish Chamber of Civil Engineers,
- Polish Union of Civil Engineers and Technicians.

Unfortunately the three “legs” are not equal, so there are no correct synergy between the two worlds. Let me show this idea on the picture below.

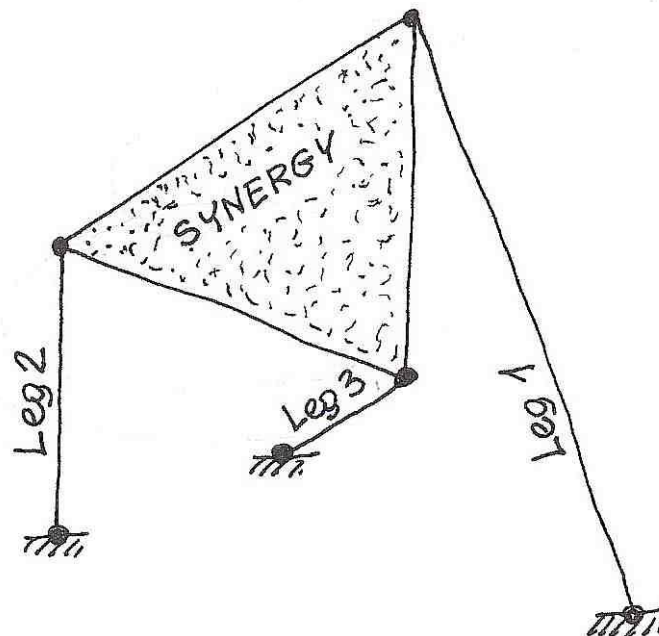


Figure 1. Sloping plane of the synergy between the academic and professional worlds.

It is difficult to say which “leg” is the most important. From the academic point of view the Leg 1 (the longest) should be ordered to the Committee, Leg 2 to the Chamber and Leg 3 (the shortest) to the Union. But, the point of view depends on the point of observation, so, we can ask professional engineers to look for a different classification.

13.7.1 Committee of Civil Engineering and Geoen지니어ing of Polish Academy of Sciences
www.english.pan.pl

The Committee of Civil Engineering and Geoen지니어ing is placed in the Division IV – Technical Sciences – of Polish Academy of Sciences.

There are 26 members of the Committee, most of them from universities or scientific institutes, but some of them are from “professional world”.

There are the following sections in the Committee:

- Concrete Structures,
- Mechanics of Structures and Materials,
- Management in CE,
- Hydroengineering,
- Geotechnics and Underground Infrastructure,
- Building Materials and Building Physics,
- Metal and Timber Structures,
- Engineering Communication,

with more than 200 scientists and practicing engineers working together in the field of:

- Examination of building structures during design, building and exploitation,
- Modernization and reparation of the structures,
- Loads acting on the structures,
- Interaction of the structure and foundation,
- Building materials,
- Environmental engineering,
- Hydrotechnical structures,
- Roads and bridges,
- Management.

13.7.3 Polish Chamber of Civil Engineers www.piiib.org.pl

The Polish Chamber of Civil Engineers is a trade self-government, next to legislative institutions, regulative structures, economy and business, constitutes an important pillar of the State of law. The activity of the trade self-government of civil engineers is regulated by the following provisions:

- The Building Law Act and acts on trade self-governments of architects, civil engineers and town planners,
- Ministerial regulations: on independent technical functions in the building industry,
- Internal resolutions: the statutes and rules and regulations of the chamber.

The Chamber groups over one hundred thousand engineers and technicians with building qualifications in the following specialities: architecture, construction and building, roads, bridges, demolition, railway, telecommunication, installations of heating, ventilation, gas, water, electrical and power systems and devices.

The Chamber membership is compulsory and only those entered into the list of its members are entitled to perform independent functions in the building industry.

The tasks of the trade self-government include, in particular:

- Exercising supervision over diligent and scrupulous performance of the profession by members of chambers,
- Representation and protection of professional interests of its members,
- Establishing the rules of the ethics of the profession and supervision over the observance thereof,
- Granting and refusing/taking away building qualifications in particular specialities and conferring the title of building expert/surveyor,
- Recognition of professional qualifications of foreigners,
- Cooperation with local government administration and local government bodies, as well as with other trade self-governments and associations,
- Providing opinion on minimum program requirements in respect to the professional education of civil engineers as well as making proposals regarding these issues,
- Trade self-government’s assets and business management,
- Providing opinion on draft normative acts regarding the building industry,
- Conducting proceedings regarding the professional and disciplinary liability of members of trade self-governments,
- Organization and administration of mutual aid institutions and other forms of material assistance to members of trade self-governments,
- Keeping the lists of members of trade self-governments.

13.7.4 Polish Union of Civil Engineers and Technicians www.zgpzibt.org.pl

The Polish Union of Civil Engineers and Technicians is a self-governments association on the scientific and practical profile. They have 30 branches in Polish towns with thousands of members from scientists, via engineers to technicians working the field of civil engineering.

The main tasks of the Union are:

- Training of civil engineers and technicians,
 - Organizing the conferences,
 - Organizing and sponsoring the competitions,
 - Publishing the newspapers in the field of civil engineering,
 - Recommendations for building industry companies,
- Providing opinion on the building

13.8 National Report for Portugal

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13.8.1 Skills Shortages

Portugal is presently facing a large internationalization within the construction industry, with companies working in East Europe, Northern Africa, Angola and Mozambique and South America. This allowed for a high level of employment for Portuguese engineers, namely in construction activities and working abroad. Design offices are also with work as they are working for the construction companies working abroad.

Civil engineers in Portugal have a broad education, so they can easily adapt to any job from design, to construction management, as soon as they face the working world.

Presently we have only a slight excess of civil engineers, has we have some unemployment for young engineers namely coming from lower rate universities.

In the next years, with the public works planned by the government to face the economic crisis (6 hospitals, 1000 km of highways, 9 dams and 700km of TGV lines) it is expected to have again a shortage of civil engineers.

In Portugal we do not face lack of candidates for civil engineering. In fact almost all our courses in public universities (7 universities plus several polytechnic at an average of 100 students) reach each year their clausus number for admissions.

Civil engineering is considered by the public as a quality profession, as we have been able to perform with quality several major public works in Portugal and abroad. Our associations try also to promote our profession (not as much as we should do). As an example with have a week TV program describing major construction works.

Skills Shortages: presently a slight unemployment, some shortage envisaged in near future
Skills Gaps: not significant due to the broad university education

13.8.2 The Skills Pipeline

In Portugal this type of problem is not significant as we have a broad education for civil engineers. In the 5th year students may choose a profile (among structures, construction, hydraulics, geotechnics and urban planning) but this means that only 4 disciplines (in the total graduation) may be different among them.

With this schema all our students have a basic formation that allows them to perform any act of civil engineer and their specialization will come with professional life.

This type of education was maintained, even with Bologna, as it corresponds to the industry desire and it agrees with our professional association.

13.8.3 Quality and Standards

The quality of the Civil Engineers coming out of the universities is checked by our National Association (Ordem dos Engenheiros) that is entitled to give the title of Engineer with which engineers may be responsible to practise acts of civil engineering.

The Ordem dos Engenheiros performs periodical evaluations of the Civil Engineering Courses at the Universities (accreditation) and if approved, students from those universities may enter directly to the Association. Those that come from non approved universities need to perform an admission examination.

Presently the evaluation of the universities is being done within the European Network EURACE.

Related to Quality in Industry, most of our important construction companies have adopted the Quality ISO Standards. The problems of quality arise in small construction companies (usually up to 10 persons), but there the skills do not come from university.

In Portugal the girl-students in civil engineering are increasing reaching numbers above 30%. It is frequent to find a women directing a construction site, so we do not consider this a problem.

13.8.4 The Role of Government

13.8.4.1. Facing the Construction Industry.

Government is always between two situations: public opinion and public jobs. It is a fact that public opinion (namely intellectuals, environmentalists, etc.) tend to be against public works, defending investments in culture, environment protection, etc.

But governments know that when a crisis arrive (as it is now) the only solution to increase quickly jobs is to implement public works. In fact civil engineering works develop a multitude of jobs (reaching even non skilled workers) and they are the best engine to put economy working again.

Civil engineers have a lack of know-how in defending their image. In fact they should bring much more to the public the advantages of the public works they perform. The importance of the construction companies working abroad in the country exportations is never referred as compared with classical industry. The employment associated with construction industry never is presented, but when a car company employs more 100 persons it appears in TV. We should begin to have classes about the Civil Engineering image.

13.8.4.2. Putting together Universities and Industry

Government subsidizes the universities in Portugal, but imposes low fees for the students up to the master level. This allows the industry to receive cheap (for free) engineers and they do not feel the need to involve with the universities. The only slight exceptions are:

a) Post-grad education – Where industry feels the necessity to achieve specialization in some sectors and comes to the universities to have specialized courses. There are already some University-Industry associations for specialized education in civil engineering.

b) Research – Here construction industry is not prepared to make significant investments in research. Usually they perform their own developments and they consider research a cost and not an investment. This leads to some difficulties to have PhD Students in this area as they are not recognized by the industry and their employment is usually related to Research Centres or Universities. Usually there are Government PhD scholarships, but few students candidates.

Recently Government imposed to companies winning public works an investment on research of 0,5% of the contract value. It is a good idea if companies decide to invest that amount in research with universities.

13.8.5 Impact of the Current Recession

The Government has a vast plan for public works (6 hospitals, 1000 km of highways, 9 dams and 700km of TGV lines), most of them in Concession schema.

This is the classical solution to create jobs and put the machine working again. It must be said that to create jobs building construction is better than other public works. Typically in building construction the salaries cost around 30% of the total amount and in roads, TGV, etc, that number reduces due to the increase in cost of machines.

In parallel the investment in universities was reduced around 11% what leads to management difficulties. Public universities begin to feel that they need to adopt a privatized policy to keep their quality levels.

13.9 National Report for Turkey

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This report reflects the personal opinion of the author who has been teaching in one of the leading universities of the country for the last almost forty years. During these years, he has continuously been familiar with various problems of the construction industry through the consulting work he performed. Since he has always taken part in various activities of the Chamber of Civil Engineers, he also had the chance to observe the changes in the civil engineering community and in the civil engineering profession.

13.9.1 The Current State of Civil Engineering Education

Despite the significant physical and technological improvements introduced, the level of the civil engineering education does not appear to be as high as it used to be a few decades ago. One can easily list some of the major factors causing this change:

- Civil engineering is not as popular as it used to be, most probably due to the less attractive employment conditions. The modest salary for the hard work does not appeal to the younger generation vis-à-vis the attractive income promised by the finance sector. Consequently, the best students do not prefer studying civil engineering.
- A high school graduate is admitted, on the basis of his/her entrance examination score, to a university programme among the 18-20 programmes he/she has indicated in order of preference. Very few students are placed in programmes of their first choice. In other words, majority of the civil engineering students are studying civil engineering, although it is not their favourite subject.
- Numerous universities have been established in the last three decades without preparing the required faculty infrastructure. So, there still are some civil engineering departments striving to train civil engineers without a sufficient number of competent faculty.
- Recent developments in the software industry are misinterpreted by engineers and engineering students. They have the illusion that the blind use of the software available in the market makes them engineers. This is another important factor that makes the students lose their already insufficient motivation and interest.

However, the author is not pessimistic about the above explained level of education. His teaching experience abroad (USA, Canada, New Zealand, UK) gives him the impression that these problems are rather universal.

13.9.2 The Construction Industry

The construction sector occupies an important place in the Turkish economy. It may presently be somewhat slow due to the global and local economic fluctuations. However, it will no doubt come back and resume its leading part soon. In other words, civil engineering is still a much needed profession due to its great work potential and will remain that way during the next few decades. The industrial and social infrastructure of the country has not been completely constructed yet. Besides, the existing infrastructure is aging and thus is in need of rehabilitation and possible expansion. Another

considerable work potential lies in the seismic retrofitting of the existing building stock or its replacement.

As far as the level of civil engineering practice is concerned, construction industry displays a peculiarity and takes place in the two extremes. On the one hand, top quality design and construction services are provided by the leading companies successfully competing all over the world. On the other hand however, a substandard even deficient civil engineering practice is quite widespread. The typical example of the work of the latter category is the huge seismically vulnerable mid-rise building stock resulting from improper design, substandard construction, deficient materials, improper workmanship etc.

The unsatisfactory civil engineering practice mentioned above cannot be directly attributed to the problems of civil engineering education. The contribution of the insufficient and possibly incompetent construction supervision system cannot be ignored. The present construction supervision system seems to require a substantial revision.

13.9.3 The Need for New Civil Engineers

The present number of civil engineers registered with the Chamber of Civil Engineers is around 70 000, and more than 3 000 new graduates are being added each year. In view of the expectations of the “Five-Year Development Plan” of the State Planning Agency, this is a rather satisfactory picture. However, the author tends to attribute more importance to quality than quantity, thus he is primarily interested in increasing the number of qualified and capable civil engineers. He considers the present number of undereducated, barely standard civil engineers adequate, if not excessive.

The author is convinced that the establishment of a professional engineering system may significantly contribute to the betterment of the civil engineering practice, through social encouragement for the engineers to improve their educational and professional performance level. A good deal of progress has been made in the last three years towards the development of a professional engineering system within the Chamber of Civil Engineers. The system is expected to become operational in Spring 2009.

Continuing education is another important component that may help the improvement of the civil engineering practice. Construction industry does not seem to pay the due attention to continuing education. Few companies care to encourage their employees to take continuing education courses, and even fewer organise such courses themselves. However, to enforce continuing education, the Chamber of Civil Engineers requires a certain number of continuing education credits for renewal of licence. To this end, they organise hundreds of continuing education courses all over the country every year, and issue credits to the attendants. They are presently in the process of improving the contents and standards of these courses.

13.10. National Report for the United Kingdom

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13.10.1 Skills Shortages

One of the key issues facing the Industry is a shortage of numbers (NCE 17 Jan 2008). In the UK, the Industry has a great deal of work (Olympics, Crossrail, etc) but is struggling to find staff for all the potential infrastructure projects we need to undertake. The problem is widespread, but particularly notable in ground engineering, which is central to almost all construction and building projects (NCE 27 Nov 2007). Other areas of shortage include project management (ICE State of the Nation Report Jan 08) At present, we are taking workers and engineers from abroad. In the long term, this is neither sustainable nor morally justifiable. We need to expand the intake into university courses, but there is a key problem here, namely preparation in schools.

CIC BEPS Survey 03/04 identifies problems with shortages in management, communications, literacy, problem solving and client handling. On the technical side, IT, agreeing design schemes, design development, procurement strategy and controlling construction operations are shortage issues. However, these are topics which are best learned by gaining experience on the job rather than in formal education. Perhaps the role of Universities here is to create awareness of these topics rather than to teach them in a formal sense.

Somehow, both companies and young professionals, coming up through the University system must become more committed to the Profession. Hence there is a role for both to excite and inspire young people.

Visibility is a problem. Universities and Industry could collaborate much more to influence the general public and young people about the importance of Civil Engineers in providing our living environment

Skills shortages are also problems for some existing staff, raising the whole question of CDP and retraining. The big problem here is companies not having the time to release people and the workload of existing staff going up all the time because of difficulties of recruitment and retention.

13.10.2 The Skills Pipeline

One of the key problems we face is the level and type of preparation in schools. Getting pupils to make the right subject choices early is essential if we are to have a good supply of students coming forward for University study. This is a big issue in the UK and Industry is trying to increase its influence so that school pupils think about possibilities of working in Civil Engineering at an early age, so that they stand more chance of making the correct choices of subjects to study at school, giving them the correct preparation for entry to University. In the UK, there are also discussions about how to give pupils a second chance if they have not taken the correct school subjects, by having foundation courses and other means of entry. There is also the development of new school programmes in vocationally orientated studies, the aim of which is to give pupils better preparation for entry to engineering and science at University and thence to the workforce. At the time of writing, nobody, including Universities, it too clear how these courses in schools will develop, so it is not yet possible to say if they will be successful in increasing the number of students coming forward.

13.10.3 Quality and Standards

Many employers say that the general quality of UK graduates available to the Profession is good, though some feel that this is not uniform and that standards are falling in some disciplines (IStructE Dec 07), with particular problems in building services engineering. However, it is clear to all that there are not enough people of sufficient quality, both at Operative and Engineer level. UK Industry currently needs 12000 new recruits per year in Civil Engineering, Architecture and Surveying, and is finding it very difficult to achieve this. Some novel ideas are proposed for tackling this problem:

- Certain sectors, notably girls/women and ethnic minorities are poorly represented in the Profession. Why should this be? If we could interest more of these people we could overcome some of the shortages we face.
- Buddy schemes. Keep on 65 year olds, many of whom wish to continue working, or have to secure their pensions, so buddy them up with the youngsters. They will provide wisdom and the youngsters will provide the effort and enthusiasm.

13.10.4 The Role of Government

Both Universities and Industry are not helped by the attitude of Government to the Profession. Government is the biggest single commissioner of infrastructure and what Industry needs most of all to deliver Government requirements is a stable planning structure, which will encourage long term investment. Universities increasingly complain about the way that funding for Civil Engineering education has fallen, both for undergraduates, where the unit of resource is below the cost of delivery (RAEng submission to the HoC Education and Skills Committee, Dec 06) and for Masters Programmes where the amount of funding for expert specialisation has also dropped and Industry is increasingly expected to pay for this.

There seems to be an important role for Universities and Industry to work together to persuade Government of the importance of long term investment and planning for the built environment. For example, in recent times, courses have closed; perhaps some should be opened, or existing ones should be given the scope to expand. Perhaps there could be earmarked funding for Civil Engineering, just as there now is for Chemical Engineering and Materials.

13.10.5 Complementary Roles for Industry and Academe

To a large extent, Industry and Academe both know what needs to be done and by working together with Government and Professional Bodies, can achieve change. The first point is to allow for students to continue to receive a sound theoretical training, but to be able to apply it to the solution of real, practical engineering problems. This will require closer collaboration between the two sectors, for example, by course content reflecting better the needs of industry and for industry to provide more opportunities for students to gain practical experience. The second overcome the problem of stagnation of output, by training more people to cater for the skills shortage. The third is to train the New Engineer to deal with current and future problems. There is a view that courses have not changed in a significant way for many years and that they need to do so in order to be able to produce graduates who can understand and service Industry's current and future requirements. The key issue is for Universities to offer courses which inspire and motivate graduates and produce a strong supply of them, equipped with the understanding, attitudes and abilities necessary to apply their skills in the industrial and business environment. This means graduates well prepared in two broad areas: technical skills, including disciplinary fundamentals, mathematics, creativity and innovation, along with the ability to apply these in practice; and enabling skills, such as communication, teamworking, and business awareness of the implication of engineering decisions and investments.

A number of steps need to be taken to achieve these aims. These include:

- Getting things right in schools, by enhancing the understanding of what engineers do and why this is important, and by preparing pupils properly in mathematics and physical sciences. There is an important role for Industrialists here, as well as for school teachers
- Getting the approach right in Government, by the provision of adequate funding for university engineering courses and a stable planning framework for infrastructure investment and development.
- Getting the accreditation process to act as a driver for change rather than simply as an audit of quality
- Getting more industrial input into undergraduate programmes, via more industrially relevant projects, visiting lecturers, industrial placements and case studies
- Making undergraduate courses more inspirational, so that graduates are encouraged to remain in the sector
- Re-addressing the balance between research and teaching in universities to ensure that while research excellence is maintained, the importance of teaching is not neglected.
- Recognising the importance of specialist postgraduate training for Industry, including both Masters and PhD programmes
- Enhance and re-structure continuing professional development more towards the needs of Industry, and make it easier for people to retrain
- Attract Engineers from a wider cross-section of the population, many sectors of which, such as girls/women and ethnic minorities are currently very under-represented
- Retaining staff already in the Industry, by maintaining and improving salaries and conditions. Over the years, too many good people have left because of disillusionment and poor salaries.

Another way of looking at this is to consider Engineers as operating in three difference spheres:

The Engineer as Specialist:	deals with technical issues
The Engineer as Integrator:	operates across boundaries in a complex business environment
The Engineer as Change Agent:	focuses on innovation, creativity and leadership

It is also important for Industry to value its staff, especially the unsung heroes, including the technical staff who undertake some of the less glamorous but incredibly vital tasks such as designing water treatment plants and maintain the underground (NCE Jan 2007)

13.10.6 Impact of the Current Recession

This is necessarily a short and brief note at this stage, January 2009, but the interaction between Industry and Academe will be greatly affected by the current world economic downturn. It is perhaps too early to say how things will work out, but the following are likely:

- Jobs are likely to be hit hard, so there will be increased unemployment in the Construction and Building Sectors
- This may have an impact on how young people perceive Civil Engineering as a career and therefore whether they are likely to apply for places at university. However, the economic crisis covers many sectors, not Civil Engineering alone
- Some staff who are made redundant may take the opportunity to re-train and re-specialise, which could lead to a boost for university entrance
- Governments are likely to make cuts in education budgets, which may well affect the operation and staffing levels in Universities
- On a more positive note, the crisis might give scope for new developments and technologies, including sustainable construction, introduction of sensor technology in building, new materials, etc
- In addition, public investment, in infrastructure, housing and so on, may be seen as a way out of the economic crisis.

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