

WORKING GROUP H: DEVELOPING A SYNERGY BETWEEN THE ACADEMIC AND PROFESSIONAL WORLDS

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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.

SCOPE OF WORK

Group H has been set up within EUCEET 3 to consider ways in which academic and professional partners within the 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.

1. 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.
2. To compile a dossier of this information to be made available to all EUCEET members to assist them when updating their curricula.
3. 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.
4. 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.
5. 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
6. 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.
7. 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.

WORKING METHODS

We are firmly of 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 the approach would 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; it would be necessary to survey EUCEET members in order 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.

The main method of working will 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.

REVISED TERMS OF REFERENCE

In the 18 months between the Group 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. 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.

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 problem 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 preparing 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. 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 civil engineering, 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 EUCEET 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 in its deliberations on the Common Platform, but not in taking a lead in this matter.

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 EUCEET 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 EUCEET, the EUCEET Association or individual members should be to act as technical specialists and educational specialists.

Industrial Workshops

The possibility of EUCEET 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. EUCEET certainly has a role to play in gathering and disseminating information about industrial needs. Detailed work is probably best done at local level, with members developing their networks, while EUCEET itself could make much more effective use of its time and resources by collecting this information together, summarising and disseminating it as part of a national 'State of the Art Report' for individual countries.

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

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. All EUCEET members were invited to complete a questionnaire and results are given in section XXX.

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 EUCEET 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 by EUCEET members. It is set out in section XXX.

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
- Received/ 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 these is set out in section Y and full documents are available as appendices.

A REVIEW OF 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 areas, eg design classes						
Use of Industrialists in specialist areas eg construction management						

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

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.

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.

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. The rest are in the middle.

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.

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.

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 do it themselves. Of those using industrial specialists, 50% consider this link to be important/very important and 13% say that it is not important.

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' university life 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 world case students can do to motivate students.

Although this external 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. There has been little consideration of this topic so far, and it is one that may warrant further consideration.

INNOVATIVE WAYS OF WORKING WITH INDUSTRY

CJK to check than Carsten's stuff is included

Civil Engineering departments throughout Europe have many industrial links, as would be expected of a vocational discipline. The range and extent of these links have been described before in EUCEET work, and this Working Group has carried out a survey to review and update knowledge on these. As would be expected, the most important and popular collaborations include the use of specialist lecturers and the provision of site visits for students, but the range of links is wide.

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. More than twenty universities 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' is 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
- Any others?

Brief details are set out below, alphabetically by Institution, as examples of good practice. Where possible, contact details are given so that those who are interested can seek further information.

(NOTE: In this draft, most contact details have not yet been added. They will follow in due course – Action CJK).

Budapest University of Technology and Economics (BUTE)

(Note: A short summary of the contents of the files listed below needs to be included here. CJK to draft, and to discuss with AS/GF)

BME Civil Engineering College for Advanced Studies: CE_College_BME_HU

Civil Engineering Week CE_WEEK_BME_HU

IAESTE – Hungarian Group

See the attached file: IAESTE_BME_HU1 and IAESTE_BME_HU2

<http://bme.iaeste.hu>

<http://sz7.iaeste.hu>

Cantabria

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.

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.

Cardiff

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.

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.

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.

Conseil Nationale des Ingenieurs et Scientifiques de France (CNISF)

The contribution from CNISF covers the sector as a whole, outlining developments in a number of French Institutions.

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.

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.

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
- Eco-design and climatic engineering, ENSAIS (Strasbourg) introduced innovative courses
- 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.

Darmstadt

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 view 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, Career Fairs and joint training in companies are offered to students to enhance their knowledge of the 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. For further information about the fairs click here: <http://www.konaktiva.tu-darmstadt.de/>

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

where you can get more information about them. **(Note: Does the text here cover what is in the website, or do we need a further summary or translation? Can Ulvi please advise?)**

TU Delft

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/>

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>

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](#).

1. 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 knowledge. 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.
2. **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.

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:

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

TU Denmark

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.

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.

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.

Heriot Watt University, Edinburgh

(Note: More details to be requested from Ian May).

Use of people from Industry to debrief students about designs and in “crit” sessions.

We also have something similar to your example 3.

Ecole Nationale des Ponts et Chaussées (ENPC - Paris)

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 wool concretes (fibre-reinforced?), 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

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. The must also submit drawings.

Ecole Speciale des Travaux Publics, du Batiment et l'Industrie (ESTP Paris)

The ESTP Construction Fair

This is a student-let 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.

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.

Helsinki University of Technology

The relationship between students and the industry in civil engineering branch in Helsinki has traditionally been cultivated very actively. Both parties will get use of this versatile co-operation. Students will get contacts to the professional world, and get also some preliminary knowledge of the demands directed to them, or waited for from graduating engineers, generally. The industrial side will learn to know better candidates, possibly employed in the future, 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 rather often will be instructed and paid by the industrial side.

The Guild of Civil Engineers has traditionally been the activator in the intercourse between students and industry. It is an active subgroup of The Student Union of Helsinki University of Technology. The guild, founded in 1913 has a long and distinguished history. The membership consists mainly of students of Structural Engineering and Building Technology and Transportation and Environmental Engineering.

The Guild of Civil Engineers plans and organizes parties, excursions, theatre visits, sport events and other events for its members. The guild arranges a lot of activities 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.

The co-operation with the companies starts in the beginning of academic year and continues throughout the studies. This co-operation brings students closer to work life and thus makes it easier for the students to apply for jobs in these companies.

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

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 in Finland donates the overalls and the representatives of the company come to help with the distribution and managers give a speech about the importance of studies. At the end, students toast for their studies and co-operation with the company.

Sports day is organized for the freshmen a few weeks after beginning of studies. It is financed by another major company in construction business. 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 in a more casual manner with the representatives, see Figs. 3 and 4.

These two events are very popular among students and also the companies want to be a part of them every year. Both the students and the companies enjoy the events and they establish relations with each other.

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. Contacts: Professor, D. Sc. (Tech.) Aarne Jutila, Lic. Sc. (Tech.) Torsten Lunabba

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 members 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. The winning proposal is presented in Enclosure 2.

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).

Imperial College London

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>

Industrial Contrubutions 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

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.

Laboratoire Central des Ponts et Chaussées, Paris

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 in providing opportunities for students to meet industrialists, see their work and discuss job opportunities.

Marseille

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-ingenerie.fr/fr/evenements/rencontresdel8217ingenierie/rencontres2007/programme_5p.pdf

Industrial Staff

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.

Middle East Technical University, Turkey

Construction industry contributes to the educational activities of the universities only through indirect channels. Some of these contributions are explained below on the basis of the example of Department of Civil Engineering, Middle East Technical University.

- **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 consider the needs and wishes of the industry 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.
- **Capstone Design** – Experienced practicing engineers actively participate in the instruction and supervision in this must course. Furthermore, design problems assigned every year are usually chosen from the actual practice to familiarise the students with the facts of life.
- **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.
- **Technical Electives Given by Practicing Engineers** – Several technical elective courses are given by part-time instructors who are experienced practicing engineers.
- **Summer Practice** – This is an old fashioned but rather effective activity leading to direct involvement of the students in the actual engineering practice.
- **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.

Pardubice

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

Kontakt 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

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.

Porto

Strategy for the Bologna Process

Following the introduction of the Bologna Process, the Civil Engineering School established a Advisory Group of teaching staff and Industrialists, with the aim, amongst other things, of incorporating industrial perspectives and future needs into the new first and second cycle curricula in civil engineering. The Industrialists represented recognized institutions and organizations reflecting the wide scope of civil engineering jobs and activities. The report which was produced formed the basis of a debate amongst academic staff and fled to the adoption of an new model for education, which is currently operating..

Prague

Student competition: “Hall of the Year”

Contact person: Dr. Zdara, zdara@fsv.cvut.cz

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>

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.

Riga

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,/>

Serres

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.

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.

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.

Tallinn

Industrial Connections

In Tallinn University of Technology, there are a number of different examples of co-operation with Industry. The Faculty organises meetings with the leading civil engineering companies, in which company 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 has 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.

Timisoara

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.

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 and industrial bodies, government ministries and other interested groups, and it is therefore probably 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 material submitted is summarised in this section and individual national reports are provided in a separate appendix.

Skills Shortages

Staff/skills shortages are seen as an ongoing problem and a limit to growth (CZ), 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. .

Providing the Missing Skills - The Skills Pipeline

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.

Quality and Standards

(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.

The Role of Government

(Question: Should we have a Role of Industry? Many of the answers had more to do with what Industry might do than what Government should do)

(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. 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. 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) 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

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.

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.

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

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 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 are 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.

APPENDIX 1: LIST OF PARTICIPANTS

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

Alhan, Cenk	Istanbul University, Turkey
Arslan, Ulvi	TU Darmstadt, Germany
Brattelund, Eivind	NTNU Trondheim, Norway
Castro, Daniel	
Dicu, Mihai	UTCB Bucharest, Romania
Dima, Serban	UAICRRO, Romania
Dima, Vasilica	Procema, Romania
Emeriault, Fabrice	INSA Lyon, France
Farkas, Gyorgy	BUTE, Hungary
Fernandez, Pedro	UP Madrid, Spain
Hausen, Maria	
Jutila, Aarne	Helsinki University of Technology, Finland
Karanassios, Nicolaos	
Kerr, Colin	Imperial College London, UK
Latinopoulos, Pericles	Aristotle University, Thessaloniki, Greece
Le Tallec, Bernard	ISBA Marseille, France
Liias, Roode	TU Tallin, Estonia
Mouraridis, Errikos	TEI Serres, Greece
Muhlbauer, Christian	TU Munich, Germany
Neocleous, Nicos	Cyprus Association of Civil Engineers, Cyprus
Pagliara, Stefano	Universita di Pisa, Italy
Paavola, Juha	Helsinki University of Technology, Finland
Papageorgiou, Demetrios	TEI Piraeus, Greece
Semprich, Stephan	TU Graz, Austria
Skrzypek, Thibaut	ENPC, France
Smirnovs, Juris	TU Riga, Latvia
Steen Moller, Jacob	TU Denmark
Stragys, Vincentas	TU Gediminas Vilnius, Lithuania
Tankut, Tugrul	Turkish Chamber of Civil Engineers, Turkey

APPENDIX 2. INNOVATIVE WAYS OF WORKING WITH INDUSTRY

The following organisations contributed examples of innovative ways of working with Industry.

Budapest University of Technology and Economics, Hungary
 Cantabria, Spain
 Cardiff University, UK
 Conseil Nationale des Ingenieurs et Scientifiques de France, France
 Darmstadt, Germany
 TU Delft, Holland
 Heriot Watt University, Edinburgh, UK
 Ecole Nationale des Ponts et Chausses, France

Ecole Speciale des Travaux Publics, du Bariment et l'Industrie, France
Helsinki University of Technology, Finland
Imperial College London, UK
Laboratoire Centrale des Ponts et Chausees, France
Marseille, France
Middle East Technical Univeristy, Turkey
Pardubice, Slovakia
Porto, Lisbon
TU Prague, Czech Republic
TU Riga, Latvia
Serres, Greece
TU Tallinn, Estonia
Timisoara, Romania

APPENDIX 3: NATIONAL 'STATE OF THE ART' REPORTS

There are XX, which can be made available as appendices. They will also be made available on the EUCEET website:

<http://euceet.eu/workgroups/h/index.php?id=83>

They are in the file list as 'State of the Art.....Country Name. The UK file, which was the initial example, is listed as 'State of the Art Template'