

# **Cross European Collaboration in Civil Engineering Education**

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Over the past ten years the opportunities for students to gain experience of Academia and Industry in other European countries has grown apace, mostly financed through the European Union funded TEMPUS and ERASMUS schemes. Alongside these opportunities has been the acknowledgement that with the growing emphasis in the Construction Industry in Europe towards "Design and Build" there is a need for a Civil Engineer who can "Manage the Construction Process" from inception to completion. Thus the national and European awards in Civil Engineering Management recognize the need for an academic course of study providing not solely the traditional technology subject area but balanced combination of technology and management. This paper reports on the development of a national Civil engineering Management degree programme, which had led to the first joint award in European Civil Engineering Management concurrently, offered in six separate Institutions in six different European Countries.

**Key Words:** Civil engineering Education, Cross European Education, United Kingdom

## **Introduction**

Historically the growth of built facilities in the United Kingdom stemmed from the rapid industrialization during the nineteenth century, particularly housing for the expanding population settling in the towns and factory premises as places of employment. Work of this nature required a variety of craftsmen who formed the basis of today's building sector.

Such rapid expansion clearly put pressure on the infrastructure causing canals, railways and roads to be constructed, together with a general requirement for public utilities. These areas of activity gradually coalesced into the Civil Engineering disciplines, which demanded sound engineering knowledge relating to structural analysis and design, fluid mechanics, water engineering, geotechnics and some aspects of mechanical and electrical engineering.

In contrast, the building disciplines were more concerned with the technology of buildings and the associated construction systems.

## **Educational Developments**

The education of Civil Engineers in part developed in the late Victorian Universities, but a significant and possibly the greater proportion of Engineers attended various Institutes and Colleges studying on a part-time basis (one day and one evening per week or even evenings

only), courses approved by such bodies as the Institution of Civil Engineers (ICE) (founded in the 1820's) and the Institution of Structural Engineers (I Struct E).

The Universities in particular focused on theoretical aspects of Engineering in order to sustain academic credibility with the already established science disciplines. This emphasis was less marked in the Institute/College curricula and more applied subjects were taught. The Building disciplines however, were hardly represented at all in academia, other than for craft training, until well into the twentieth century. However, the development of more complicated buildings with complex building services requirements and the use of modern materials together with a range of procurement and contracting arrangements since the 1950's have called for much better prepared professional managers of the construction process. The education curriculum for these disciplines has largely been influenced by the major professional building Institutions, such as the Chartered Institute of Building (CIOB) and the Royal Institution of Chartered Surveyors (RICS) together with a sizable number of non chartered bodies like the Architects and Surveyors Institute (ASI), Institution of Civil Engineering Surveyors (ICES), Association of Building Engineers (ABE), Institute of Building Control (IBC), Institute of Clerks of Works (ICW), etc. The majority of courses for these disciplines are based in local Further Education Colleges and Higher Education Polytechnics, with little activity in the traditional Universities. Importantly, the changes to University status of the former Polytechnics has recently brought much of Built Environment education into a more elevated arena of prestige.

It should be made clear, of course, that Architecture, a companion to the Building discipline, has long been a well sought after profession to follow, and taught in the most prestigious Academic Institutions. Unfortunately little Architecture was needed in the formative stages in establishing the nations' industrial facilities, and as a consequence, separation rather than integration of Architects, Builders, Civil Engineers, etc. is still a disturbing feature of the present day industry.

### **The Current Scene**

Unlike much of the rest of the developed world, professionals in the UK construction Industry generally need to qualify to practice through membership of one of the aforementioned professional societies. Most of these societies jealously try to guard their position in the market place and make membership difficult to achieve through a specifically accredited course of academic study and then controlled industrial training and experience requirements. This is then followed by recorded continuing professional development activities in order to retain professional membership. This system whilst laudable in itself in attempting to maintain and raise professional standards has, in practice, resulted in many aspects of their work overlapping.

Thus the opportunity now exists for a significant common programme of study in the Built Environment disciplines, which is the normal pattern in most of Continental Europe, with concentration either on practical engineering (usually termed Civil Engineering) and practical Architecture (Architecture being defined in its original meaning of master builder).

Accepting that UK traditional Civil Engineering and Architecture courses broadly cater for the demand for Design Engineers (including structural and architectural design) and /or research,

The School of Construction, Engineering and Technology at the university has concentrated on the " Master Builder" discipline, which as stated above presently covers a fragmented group of professionals including Architects, Builders, Civil Engineers, Quantity Surveyors, Building Surveyors, Construction and Project Managers, Building Control Officers, etc., that is all those involved in 'managing the construction process' from inception through to completion, working for clients, consultants, contracting firms and many others.

### Construction Degree Awards

The School has introduced the portfolio of modules shown in Table 1 covering technology and management. Specific combinations of these modules studied at the correct academic level (3

Table 1

*School of Construction, Engineering and Technology\_Construction Division*

<b>Module Portfolio</b>	
<b><u>Level 1 (Year 1)</u></b>	
Civil Engineering Technology and Materials I	Planning Design and Conservation Property Studies I
Communication	Quantity Surveying Practice I
Construction Technology and Materials I	Quantity Surveying Practice II
Construction Technology and Materials II	Statutory Control of Buildings
Contractual Procedures I	Structural Analysis I
Environmental Engineering I	Structural Design I
European Language	Surveying I
Geotechnics I	Surveying and Geotechnics
<b><u>Level 2 (Year 2)</u></b>	
Building Surveying Practice and Procedure	European Language
Civil Engineering Construction (QS)	Hydraulics
Civil Engineering Technology II	Integrated Project
Civil Engineering Technology III	Law
Construction Economics	Office Organization and Administration
Construction Management I	Quantity Surveying Practice (Building)
Construction Technology III	Quantity Surveying Practice (Civils)
Environmental Engineering II	Structural Applications
Estimating	
<b><u>Level 3 (Year 3)</u></b>	
Advanced Construction IT	Engineering Control and Procedure
Civil Engineering Technology IV	European Building Studies
Construction Technology IV	European Language
Construction Management II	Facilities Management
Contractual Procedures II	Finance
Development Economics Project	Leadership Development
Development and Evaluation of Land and Property	Plant Management
Dissertation (Double length module)	Property Law
??	A total of 50 modules (17 level 1, 17 level 2 and 16 level 3) serve the 6 named degree awards.
??	Each module is worth 15 credits except the Dissertation (30 credits)
??	A 15 credit module involves 150 hours of student effort. Lecturer contact time (Lectures, tutorials, practicals etc.) is approximately 45 hours
??	Students would normally expect to study 8/9 modules (120/135 credits) per academic year.

levels basically equivalent to each of the 3 years of academic study) allow the award of a named degree.

A Bachelor of Science programme can be awarded at Ordinary level [BSc.] or at a graded advanced Honours level [BSc.(Hons)] depending on the number of credits successfully achieved, normally 280 credits for a BSc and 310 for a BSc Honours award. Most students would study for the Honours level award but depending on the quality of their module results may 'fall back' to an Ordinary award.

Taking two of the degrees offered Tables 2 and 3 illustrate how modules are combined to give named degree awards, and also highlight modules that are common between the two programmes.

Table 2

<i>School of Construction, Engineering and Technology Construction Division</i>	
<b>BSc (Hons) BUILDING MANAGEMENT</b>	
<b>YEAR 1</b>	
<b><u>Communication</u></b>	<b><u>Contractual Procedures I</u></b>
<b>Construction Technology and Materials I</b>	<b>Environmental Engineering I</b>
<b>Construction Technology and Materials II</b>	<b>Statutory Control of Buildings</b>
<b>QS Practice I</b>	Surveying and Geotechnics
<b>YEAR 2</b>	
<b><u>Construction Economics</u></b>	<b>Estimating</b>
<b><u>Construction Management I</u></b>	<b><u>Integrated Project</u></b>
<b>Construction Technology III</b>	<b><u>Law</u></b>
<b>Environmental Engineering II</b>	Structural Applications
<b>YEAR 3</b>	
<b><u>Construction Management II</u></b>	Optional Modules (minimum of 1 to be studied)
<b>Construction Technology IV</b>	<b><u>Advanced construction IT</u></b>
<b><u>Contractual Procedures II</u></b>	<b>European Building Studies</b>
<b><u>Development Economics Project</u></b>	<b><u>European Language</u></b>
<b><u>Finance</u></b>	<b>Facilities Management</b>
<b><u>Dissertation</u></b>	<b><u>Plant Management</u></b>
	<b><u>Leadership Development</u></b>
??	Modules in <b><u>Bold and underlined</u></b> indicate those studied in common with the BSc (Hons) in Civil Engineering Management.
??	Modules in <b>Bold</b> only, are studied in common with other construction degree programmes.

The School offers Bachelor of Science Honours Degree programmes in:

- ?? Building Management - (Table 2)
- ?? Building Surveying
- ?? Civil Engineering Management - (Table 3)
- ?? Civil Engineering Surveying (Quantities)
- ?? European Civil Engineering Management
- ?? Quantity Surveying

As can be seen, most of the degree awards (see Tables 2 and 3 as examples) share a broad core of modules, particularly at levels 2 and 3 (years 2 and 3). Indeed if the Industry was less

fragmented, a single degree title under the Construction umbrella would probably suffice, with perhaps options available to allow some specialization.

Table 3

<i>School of Construction, Engineering and Technology Construction Division</i>	
<b>BSc (Hons) CIVIL ENGINEERING MANAGEMENT</b>	
<b>YEAR 1</b>	
<b><u>Communication</u></b> Civil Engineering Technology and Materials I Civil Engineering Technology II Surveying I	<b><u>Contractual Procedures I</u></b> Structural Analysis I Structural Design I Geotechnics I
<b>YEAR 2</b>	
<b><u>Construction Economics</u></b> <b><u>Construction Management I</u></b> Civil Engineering Technology III <b><u>Integrated Project</u></b> <b><u>Law</u></b> Hydraulics	<b>QS Practice (Civils)</b> Optional Modules (minimum of 1 to be studied) <b>Office Organization and Administration</b> <b>European Language</b> <b>Leadership Development</b>
<b>YEAR 3</b>	
<b><u>Construction Management II</u></b> Civil Engineering Technology IV <b>Engineering Control and Procedure</b> <b><u>Development Economics Project</u></b> <b><u>Finance</u></b> <b><u>Dissertation</u></b>	Optional Modules (minimum of 1 to be studied) <b><u>Advanced construction II</u></b> <b><u>Contractual Procedures II</u></b> <b><u>European Language</u></b> <b><u>Plant Management</u></b> <b><u>Leadership Development</u></b>
?? Modules in <b><u>Bold and Underlined</u></b> indicate those studied in common with the BSc (Hons) Building Management.	
?? Modules in <b>Bold</b> , only are studied in common with other degree programmes	

Another factor which has led us to believe that this university's approach towards educating professionals to 'manage the construction process' is the way forward in the development of 'Design and Build' contracts. Many major Civil Engineering projects in the UK are let on this basis such as The Channel Tunnel, the bridge over the River Thames at Dartford, the new bridge over the River Severn into Wales near Bristol and the Birmingham Northern Relief Road. These projects require the construction professionals to work together as a team to manage the complete construction project from inception to completion, rather than the traditional compartmentalizing of each of the professions inputting their expertise at various stages of the contract.

In no way do we advocate replacement of established traditional courses but we consider our courses are totally complimentary to the existing provision and provide an expertise in human resource management that is urgently required.

Graham Mackenzie the Director General of the Engineering Employers' Federation has recently stated to the Engineering Council that the education and training of Engineers is outdated and not strategically focused to suit Industry's needs. An overhaul of the process to ensure that Engineers and Technicians are multi-skilled, have business and finance skills and are good communicators is essential. We consider that the degree courses we offer at this university tackle this shortage of skills required by today's Engineers.

## European Civil Engineering Management

In the rest of this paper we will specifically consider the provision within the area of Civil Engineering both with the national course and with its development onto the European Continent.

The BSc Civil Engineering Management (CEM) was introduced in 1990 and graduates from this course have gained specific employment because of their training in technology and management. For example, one Engineer was temporarily transferred from the Local Authority that he worked for to a national firm of Consulting Engineers to work in the Middle East to use his marketing and managing skills in developing a new regional office.

During the planning and implementation of the CEM programme we were in consultation with Institutions on the European Mainland, who, when they saw our proposals considered that such a programme was also directly relevant to the Construction Industry in their countries. This therefore led to the implementation of a BSc European Civil Engineering Management degree award, initially with partners in Germany, Holland and Poland commencing in October 1992. It now also includes partners in the Czech Republic and Hungary with Denmark, Greece and Ireland due to join in October 1995. The course is of 4 years duration with 3 years of academic study and 12 months industrial placement. The programme allows for study both at the home Institution and at one or more of the foreign Institutions (See table 4).

However whilst most of the continental students have a good command of English, the same does not usually hold for British students, although a foreign language is an essential element in the curriculum from the beginning. In fact the only difference in academic content between our national and European programmes is that in the national programmes foreign language study is an option whilst in the European programme it is essential. To help overcome this reluctance of the British to learn foreign languages, all students are required to undertake the 6 months of industrial placement in the foreign country before undertaking formal curriculum studies. Also, at the foreign Institution some subjects will initially be taught in English.

Table 4

### *European Civil Engineering Management Course Programme*

YEAR 1		YEAR 2		YEAR 3		YEAR 4	
SEM	SEM	SEM	SEM	SEM	SEM	SEM	SEM
1	2	3	4	5	6	7	8
T	T	T	P	P	T	T	T
H	H	H	H	A	A	A	H

T = Taught Theory Semester  
P = Industrial Period Semester  
H = Based at Home Institution  
A = Based at Foreign Institutio

#### **SUMMARY**

4 Year (48 Months) overall programme of study  
30 Months based at Home Institution  
( 6 Months spent in Industry at Home )  
18 Months based at Foreign Institution  
( 6 Months spent in Industry in Foreign Country )

At present Semester 8 must be completed in the home country in order to qualify for the degree award initially registered i.e. BSc European Civil Engineering Management for UK students or Dip Ing European Civil Engineering Management for Continental students.

Eventually dual qualifications might be possible but presently each Institution is constrained by the quality control systems operating for the validation of degree awards pertaining to that Institution. For instance at present this University has only validated the the modules taught at the foreign Institutions in Semesters 6 and 7 along with the Industrial placement in Semester 5 rather than the whole of the course in each Institution.

This university has gained registration to Part 1 BS EN ISO 9000, the British, European and International Standard for Quality Systems for the whole of its core business " the design and delivery of learning experiences with provision for research and consultancy services".

The host Institution in line with current European Union legislation on student mobility receives study fees. For European Union students' tuition fees are claimed back through Wolverhampton Metropolitan Borough Council, for non-European Union partners a reciprocal exchange scheme has to operate so that we do not charge them tuition fees and they do not charge our students. However subsistence grants are not generally available for the foreign students except through the European Union funded grant scheme called ERASMUS for European Union students and through the European Union funded grant scheme called TEMPUS for the Eastern European partners. Employers do make nominal payments towards subsistence expenses.

Despite the recession in the Construction Industry in the UK, we have managed to place, in Companies, the foreign students studying with us in 1994/5 (10 students from Germany, 5 from Poland and 2 from Czech Republic) and 1995/6 (15 students from Germany, 5 from Poland and 2 from Holland) These have and are working with Contractors, Consulting Engineers and Local Authorities.

With approximately 200 students studying on the ECEM programme in the 6 partner Institutions, each Institution has to plan and agree with all partners its intake each year to ensure that the students are able to study after the end of Year 2 at the foreign Institution of their choice. The host Institution is responsible for finding accommodation for visiting students and also for placing them in industry.

Formal meetings of the partner Institutions are held 3 times a year to consider all the problems that do arise from such an innovative study programme and to date things have run reasonably smoothly, but funding problems are likely to occur at the end of the next academic year when the European Union funded ERASMUS and TEMPUS schemes finish. However, it is intended to bid for support from the projected replacement schemes. Information on the replacement schemes suggests that support will be given to more flexible and wider based partnerships. This will fit in with our intention to expand our European course provision in Wolverhampton to include all the Construction professions represented by our degree programmes rather than just Civil Engineering.