INTERNATIONAL BUILDING

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Abstract — *Engineering education of today must adopt an international approach in order to prepare students for work on an international arena. The purpose of this paper is to give an example of a successful approach to international learning. The case described, Civil Engineers on Tour, CET, is a project run by last year students in Civil Engineering at Luleå University of Technology in Sweden. Every year the students start a company with the purpose of organising a study tour abroad. The activities within the company are to arrange contact evenings with the Swedish building and construction industry, get sponsoring, organise and realize the study tour and the study visits in the country contemplated. The learning achieved is a good insight in international building and the specific problems in connection with this. The links between the university and the industry have been strengthened; the students have broadened their social and cultural understanding.*

Index Terms — Engineering education, project work, internationalization, international cooperation, international training

PURPOSE OF THE PAPER

The purpose of this paper is to give an example of a successful approach to international learning. The case described in the following text is a project run by last year students in Civil Engineering at Luleå University of Technology in Sweden. Luleå University of Technology is a medium sized university located in northern Sweden, established when the former university college in Luleå became the first to attain the status of university of technology in 1997. Luleå University College was established in 1971 because of the developmental policy in Sweden at that time. The idea was to provide the region's main industries with well-educated engineers. The first programs were in mining, geo-technology, and mechanical engineering. Natural resources in the area are iron ore, forest, and water, with the main industries in the region still very much dependent on extracting and refining natural resources from the mines. The need for engineers within the basic industries was one of the driving forces behind the establishment of the university in Luleå. Today, 30 years after the foundation of the university the labor market situation is different. Today we are educating engineers for work on a more global arena. The local society has also become more international oriented. From a globalization perspective, building alliances around the world is essential.

What impressions of globalization are considered within education? One thing is obvious, engineering students graduating from universities in Sweden, according to many investigations, prefer jobs in companies with international business operations, like NCC, Skanska, PEAB. How can we match the complexity of the environment, and regional and global demands within education? Can we stay regional and still act on a global market? Today, we participate worldwide at every moment. We participate in real time in construction tasks with students at Stanford, in research together with the European automobile industry in northern Sweden, in mining projects and education in Mexico, and in wood technology projects in New Zealand and South Africa, just to give some examples.

Another way of preparing students for working on an international market adopted by the School of Civil, Mining and Environmental Engineering has been to run and support a study tour for the final year students for the last 25 years. The concept with a study tour was created by professors with foresight. One of them was an entrepreneur from the construction industry. Besides the study tour this man also initiated the 7 months of practice for the final year students in building and constructing companies that still exist within our Civil Engineering Programme.

OPERATIONALIZATION OF THE INTERNATIONAL DIMENSION

The idea of the study tour is based on the idea of the importance of internationalization. Every year the final year students in Civil Engineering at Luleå University of Technology form a company, an economic association. The company has well developed subgroups taking care of arrangements with sponsors, contacts with companies in foreign countries to arrange study tours, traveling and hotel reservations, financial management, general contacts with the Swedish industry to arrange contact evenings and also to publish an annual magazine. The whole arrangement serves as practical project work. It also serves the purpose of supporting the interface between the university and the Swedish industry, the students and their future employers, features that are very important success factors for Luleå University of Technology. Besides, working in the project gives the students a good insight in international building, and specific problems related to the process of building in another country and also a knowledge and better understanding of the cultural and social dimensions related to building and construction.

When the project is finished, when the whole years planning and the final study tour is carried through, the students get academic credits for their work through a course, International Construction [1]. The content of the course, according to the syllabus, is in alliance with the content of the work they have done, the lectures they have got during their study tour, the knowledge they have gathered in confronting huge international building and construction projects, project management in areas with insufficient infrastructure, norms and regulations from an international perspective and also from knowledge about the building and construction industry in important growth areas. The group is accompanied, supported and sponsored through the planning and realization of the study tour by the Department of Civil, Mining and Environmental and by the

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Swedish industry operating abroad. The students are doing all the project work just with the coaching from the professors and sponsors around them. It is their project. The whole project can also be described as a democratic project. While working, the students learn to practice team work, to find creative solutions on problems that arise, to negotiate, to compromise, to cooperate, make and implement decisions and so on; and also to be realistic about their project and to stick to their plans and commitments.

The students have chosen to go to different countries over the years. The last years they have chosen to travel to Brazil [2], Japan and Malaysia [3], China [4], and Canada and USA [5]. After the study tour the students report from their experiences in their annual magazine, Bygga Framtid (Building the Future) published at the Department of Civil, Mining and Environmental Engineering at Luleå University of Technology. The report serves as a link and a feed back to the sponsors, to the Swedish building and Construction Industry operating abroad. The report also inspires the next years student group to work hard to be able to go on tour next year.

CET – 2009, REPORT FROM A STUDY TOUR

As a result of a project work described in this paper we have chosen to report from the CET study tour to Canada and the US that was conducted earlier this year [5]. The study tour started in Sweden on the 20th of April 2009 when the students were on their way to the examination of the course International Construction. The first study tour took place in Sudbury, Canada where they met Atlas Copco's sells office and got a thoroughgoing presentation of the company and of Sudbyry as a mining town. In order to give the customers maximal service the company has a large repair shop where machines can be maintained and modified to specific conditions in every mine where the machine is going to be used. Recycling of coromant drills were also shown. The day after Copper Cliff North Mine Sudbury was shown to the students.

The next study visit was at Habitat for Humanity in Toronto. The company's vision "To eradicate poverty housing" was impressing. The company is operating in more than 100 countries all around the world helping one family to better housing conditions every ten minutes. The help is provided on certain conditions: need, income and willingness. Among those who are interested to get a home through Habitat about two out of ten are selected. The students also visited a building site where a Swedish company was building some of the houses and a local building entrepreneur was building some of the others. In order to make the building easy structural insulated panels, consisting of cell plastic in a sandwich construction were used. The simplicity in the construction and installation was appropriate for the purpose.

The next study visit was at the City Hall of Toronto followed by a city walk in Toronto's P.A.T.H underground system. P.A.T.H is a group of shops and restaurants starting with the Sheraton Hotel and Richmond Adelaide Center, and were connected in 1972. Now P.A.T.H is a system that connects large parts of central Toronto through a 26 km underground walking system. Underneath the shops there are parking places. In order to provide against fire between the buildings there is no ventilation in the paths between and they are also provided with fire doors. The design of the most exclusive part of P.A.T.H was made by the famous architect Santiago Calatrava. Next stop was the City Hall and a presentation of the Toronto water supply system. The CN-tower was also visited. It was the highest building in the world, 477 meters, before a building in Dubai took its place. Most impressing though for the students coming from a cold climate was the possibility to walk indoors in the huge indoor shopping system. Another impressing knowledge was how the snow was taken away from the streets by using melting machines and then sending the melt water to the surface water pipes.

The study tour to Canada was ended by a visit to Buffalo and to the Niagara Falls. The Niagara Falls consists of two falls, The American Fall and the Horse Shoe Falls. Originally 6060 m3 water passed the Niagara Falls per second. Nowadays about 50% of the water is allocated to a water power plant providing parts of Canada and the US with electricity. There is a fear that the falls are going to empty the Lake Erie and scientific studies are conducted to find ways to prevent a situation like that to happen. A tour with the steam boat "Maid of the Mist" was an exciting and magnificent experience to see the falls from below.

The next part of the CET-2009 study tour headed to New York. Manhattan, Liberty Island with the Statue of Liberty and Ellis Island were explored, and also the Immigrant Museum where all the immigrants to the United States was received. The visit to New York started with visiting the historical sites and improving American history and culture.

The Croton Water Filtration Project was the next project to study [6]. In June 2004 the Department of Environmental protection in New York decided to improve their water supply system. One part of this improvement is to daily filter and desinfect more than one million liter water in the Croton water supply system. The project was critizised because the water purification plant was planned to be built exactly where the driving range of Mosholus golf court in Van Cortland Park in Bronx was situated. Anyway, the decision was taken to build the purificaation plant. A consortium of a Swedish and a local company got the contract. Before the building started a large hole was digged that demanded a lot of drilling, bursting, digging and removalof material. After that the casting of the concrete foundation started. Today the building is growing up to four stores high, or rather four stores deep, because the whole building will be under the surface of the land when it is finished. All the technical

details and the logistics of the building process were presented. The project will be finished in October 2011. From this huge building and construction project the students went to see another water purification plant, even moore exciting, Cat-Del. Cat-Del is the supplier of 90 % of the water to New York. The security is enormous, the Cat-Del is classified as a tactical terrorist target. Cat-Del is situated in the country side and do not have the same problems as the Croton water supply system with colour, smell and taste of the water. The water comes from two national parks west of New York City. A tunnel leads the water to New York. Several service shafts are built to make service of the water-pipes available. These shafts were built more than 60 years ago and were built and adapted to future extentions and new pipes. Cat-Del, when extended, will be the largest purification plant, fullfilling quality demands and offering robust protection against terror attacks.

The last large building site visited during this CET-2009 study tour was the New Medowland Stadium. Even this time the Swedish building and construction company Skanska was managing the project. New Meadowland will when it is finished host 82 000 spectators at the football matches and has 200 boxes for hiring. The arena will be hosting the two big teams in New York, the Jets and the Giants.

DISCUSSION

All the study visits have been relevant to the student's education. They have been able to look at and to comprehend a lot of new information about building and construction. Having done the study tour they have also been able to grasp the concept of international building. This is the short sighted gain of this study tours. The long sighted gains will be visible long after the students have graduated. The students will through the network they have created with the Swedish industry operating abroad have an advantage when the start their career. They have also strengthened their professional networks, they have learned a lot of working with large scale projects and how to make contacts, even with other cultures. They have learned to build the future.

ACKNOWLEDGMENT

As the Head of Department I want to express my gratitude to all the students who work hard to continue this CET tradition at the Department of Civil, Mining and Environmental Engineering at Luleå University of Technology. Since this tradition is unique in our country it means a lot for the quality of our work, for keeping the good relations with the Swedish building and Construction industry, and last but not least to our esprit de corps.

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