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Organising Educational and Training Process in Cooperation with Employers

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Best practices of university interaction with employers within the educational process are presented. The paper describes an example of cooperation between the Institute of Civil Engineering and Architecture (MGSU) and employers - the construction enterprises in Moscow and Moscow region. Some forms of joint projects that improve the quality of students' training are given.

Key words: *higher education in construction, employers, master, bachelor, engineer-constructor, the main educational program.*

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In 2013 Moscow State University of Civil Engineering celebrated its 92 years anniversary. Moscow State University of Civil Engineering was established in 1927. It is is one of the best universities in the country and holds leading positions among universities in the field of civil engineering.

Today MGSU includes seven institutes:

- Institute of Construction and Architecture
- Institute of Environmental Engineering and Mechanization
- Institute of Hydraulic Engineering and Power Plant Construction
- Institute of Economics, Management and Information Systems in Civil Engineering and Real Estate
- Institute of Urban Engineering and Real Estate Management
- Institute of Basic Sciences
- Institute of Distance Education

One of the leading institutes of the University - Institute of Construction and Architecture (ICA). It was established in 2003 on the basis of three faculties: Faculty of Industrial and Civil Engineering, Faculty of Construction and Technology, Faculty of Engineering and Architecture. Before 2011 the Institute ensured education in three specialties: 270102.65 "Industrial and civil engineering", 270106.65 "Construction materials, products and structures", 270114.65 "Design of buildings".

Since 2011 MGSU has made transition to a two-tier system of education and ICA began admitting students for Bachelor and Master programs. The teaching staff of the ICA developed and introduced main educational programs (MEP) in all fields of training. Together with faculty members of various departments representatives of leading construction companies contributed to the development of MEP. They were not only involved in the curricula development process, but also initiated introducing of new profiles and fields of Bachelor level training.

For example, the profile "Cost Engineering" was initiated by the Federal Center of pricing in construction, ANO DPO "Institute of Cost Engineering" and by large construction companies, such as SU-155, Mostpromstroy, Glavstroy, Moststroymehanizatsiya, Monarch and others. Such interest of the enterprises could be explained by their need for professionals who have knowledge in the field of investment and construction

process and procedure of construction costs definition. Graduates from the program could be employed in public construction companies, joint stock companies, joint ventures engaged in the construction and operation of facilities, design and project organization. Within the collaboration the main competences required by industry from students upon graduation from Bachelor degree program "Construction" and "Cost Engineering" were identified. They must have a wide range of engineering and economic knowledge.

Below there is a list of companies involved in the development of main education program in the field of Construction:

- Profile "Industrial and civil engineering" and the specialty "Construction of unique buildings and structures" – LLC "Vibroseysmo-zaschita", CJSC "Mospromstroy", the First national organization of builders, the National Organization of prospecting engineers, Creative Production Association "Reserv", Group of Companies "SU-155", OJSC "TSNIIEP zhilische";
- Profile "Design of Buildings" – the group of companies "SU-155", the Union of designers of Russia, OJSC "TSNIIEP zhilische";
- Profile "Construction materials, products and structures" – Moscow State Unitary Enterprise Scientific Research Institute of the Moscow construction NII Mosstroy, SPC "Spetspolimer", LLC "Saint-Gobain Construction Products Rus";
- Profile "Cost Engineering" – the initiators of profile development were the Federal Center of pricing in construction, CJSC "Mostfundamentstroy", CJSC "Mospromstroy", Samara Institute of Economics and Real Estate;
- Profile "Urban Construction" – the First national organization of builders, the National Organization of prospecting engineers, Creative Production Association "Reserv".

Today the Institute continues engineer's training together with bachelor and master training in the fields and specialties shown in Table 1:

To provide full-time, part-time and distance training the Institute of Construction and Architecture has 14 departments, 11 training centers, 21 laboratories and 2 Scientific-educational divisions (Table 2).

To use the full capabilities of laboratory and research facilities of institutions when choosing the topics for graduate and post-graduate theses that could be required by industry MGSU appealed to the Board of Trustees, which includes representatives of construction companies in Moscow and Moscow region with a proposal to formulate relevant topics for master and postgraduate theses. The following companies has responded to the proposal: "Monarch", "SU-155", "Inteko", "Mosfundamentstroy-6", "DSK-1", "DSK-2", "Knauf", "Doc Rus" and others. As a result, more than 100 scientific and industrial topics were given that could be interesting for representatives of the leading construction companies, and directly related to their business or they seem profitable in the future and can be implemented in MGSU.

Close cooperation with the industry gives large opportunities for the development of targeted training of postgraduate students. Graduate student could take scientific internship training at enterprise and be engaged in research, using available facilities. At the same time the company manage his/her professional skills: his intellectual potential, strengths and weaknesses. Professional staff will always be in demand in developing production, so such students undoubtedly even during training will receive an offer to take up the position corresponding his level of skills with the possibility of career advancement.

The Institute already has such experience of students' targeted training. This form of interaction with employers has been developing since 1987.

For long years there is a contract aimed at targeted training of engineers of the specialty 270102 "Industrial and civil engineering" with OJSC "Central Research and Design Institute of residential and public buildings" (TSNIIEP zhilischa). Based on the projects of this institute, founded in 1949, large housing estates, typical and individual houses of varying heights, public welfare buildings and cultural facilities were built in our country and abroad. Currently one of the main activities of the TSNIIEP zhilische is design of high-rise residential buildings, project planning and development of large urban

Table 1. Areas of training specialists in ICA MGSU

№	Fields of study, profiles, programs	Qualification	Number of terms
	Bachelor and Specialist degrees		
1	Construction ■ profile "Industrial and Civil Engineering" ■ profile "Design of Buildings" ■ profile "Construction materials, products and structures" ■ profile "Cost Engineering" ■ profile "Urban Construction"	Bachelor	8
2	Architecture	Bachelor	10
3	Urban Planning	Bachelor	10
4	Standartization and certification	Bachelor	8
5	Technosphere safety	Bachelor	8
6	Specialty "Construction of unique buildings and structures" specialization #1 "Construction of high-rise and long-span buildings and structures"	Specialist	12
	Master programs		
1	Construction ■ Theory and design of buildings ■ Urban planning and architectural design principles of accessible environment ■ Technology of finishing and isolation materials ■ Nanomodified building composites for general construction and special purpose ■ Architectural and Construction Materials ■ Polymeric Construction Materials ■ Physics of the environment and functional bases of designing energy-efficient and convinient buildings ■ Upgrade and restoration of buildings and structures ■ Theory and practice of organizational and technological solutions	Master	4
2	Architecture ■ Architecture and design of buildings and structures	Master	4

Table 2. The ICA laboratories and scientific-educational centers

№	MGSU ICA laboratories and scientific-educational centers
1.	Laboratory of the department "Construction Materials"
2.	Laboratory of the department "Polymeric construction materials and applied chemistry"
3.	Laboratory of the department "Technology of finishing and isolation materials"
4.	Laboratory of construction physics of the department "Architecture of civil and industrial buildings"
5.	Laboratory of the department "Reinforced concrete and masonry structure"
6.	Laboratory of the department "Metal structures"
7.	Laboratory of the department "Timber and plastic structures"
8.	Laboratory of the department "Technology of binders and concretes"
9.	Laboratory of the department "Polymeric construction materials and applied chemistry"
10.	Laboratory of the department "Testing of structures"
11.	Labour protection Laborartory of the department "Integrated Safety in Construction"
12.	MGSU – KNAUF Laboratory
13.	DOKA – MGSU Laboratory
14.	Labour protection Laborartory of the department "Integrated Safety in Construction"
15.	Sector for testing of stuctures
16.	Research Laboratory "Inspection and reconstruction of buildings and structures"
17.	Sector of translucent structures
18.	Laboratory of fire and explosion safety of the department "Integrated Safety in Construction"
19.	Laboratory of production safety
20.	Testing Laboratory "Technical regulations and Quality"
21.	Research Laboratory "Urban planning and quality assessment of the living environment in settlements"
22.	Research Laboratory for the study of the actual work of construction of buildings and structures

communities (housing estates)in Moscow, Moscow region and other regions of Russia.

The organisation of "TSNIIEP zhilischa" was based on an order which involved the formation of a group of ICA students of senior courses (5-8 semesters) within the framework of the curriculum. To work in groups at design departments, they are assisted in solving practical problems in the implementation of the course and diploma projects. They have all the conditions for practical training and are paid an additional scolarship. Under this program, the Faculty of Industrial and Civil Engineering and the Institute of Construction and Architecture have trained more than 250 engineers.

Since 2002, our institute has started to form more targeted training groups in collaboration with other building organizations. Such groups are formed from senior students (usually a fifth-year students) who have shown their interest in a particular construction company and wish to work there upon graduation. Recruitment is carried out after the company's presentation and students' meeting with the management.

Taking into account specific goals and activities of particular construction company a special targeted training program(100-150 hours length) has to be developed with participation of experts from the company. The main feature of the program – its practical orientation (approximately 50%). Practical classes are held using the facilities of the construction company. Classes are provided by the ICA faculty involving other practitioners. The training costs are covered by the organization that asks for targeted training. Under this scheme, the groups of students for Holding Company "SU-155", "KIN" company and "Moskapstroy", design organizations "PI-2", "Reserv"and others were prepared.

When there is no state program of graduates' distribution and employment, the company itself is guaranteed to receive young professionals. Moreover within the training process (one academic year), students could adapt to the construction company where they will be working.

Summing up the experience of the ICA MGSU interaction with enterprises the following forms of cooperation between university- employers should bemarked out:

1. Involving construction companies in developing profiles of bachelor and master degree training;
2. Providing targeted training, including retraining, continuing professional development;
3. Formation of research topics for Master and PhD students suggested by enterprises;
4. Organization of internship training;
5. Employment of graduates;
6. Economic agreements, joint research;
7. Board of Trustees.

These forms of cooperation, of course, need to be developed by studying best practices of leading Russian and foreign higher education institutes in order to find new areas of activity, which improve the quality of educational process at universities in the field of civil engineering.

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